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THE JOURNAL OF EDUCATIONAL PSYCHOLOGY

A CONSTRUCTIVE ABILITY TEST

TRUMAN LEE KELLEY
University of Texas.

Contributions from the University of Texas Educational Laboratory, No. 8.

The number of tests which have been devised to measure general and specific traits of intelligence is so great that any new test which calls for a hearing may properly be expected to measure a new trait, or an old one more thoroughly. Before making such a claim for the present offering, a brief survey of somewhat similar tests is in order.

Many tests have been drawn up specifically with a view to securing a procedure which would not be dependent upon language, nor affected by preceding training. A test cannot be entirely free from environmental influences, but several have been contrived which are independent of preceding school training and familiarity with English or any other particular language. Manipulative and constructive ability tests in the main meet these conditions. The Sequin-Goddard form board, Fernald-Healy form boards, Healy puzzle box, Healy picture completion test, Thorndike-Stenquist constructive ability test, and many of the tests used at Ellis Island, for example the Knox cube test, are of this nature.

All of these tests are alike in that they measure the capacity of the child to accomplish an assigned task. In every case the end is set by the experimenter or by the test. As tests, the object of which is to solve a given problem, they are excellent, but they do not measure the ability to initiate a problem.

The constructive ability test here presented attempts to measure the ability to initiate as well as to execute a task. With such an object in view, the end cannot be set for the child. Another requirement of a useful test is that it shall be capable of accurate grading and standardization. It has therefore been attempted to devise a test which (1) is free from dependence upon language, (2) is free from preceding formal training, (3) tests initiative as well as manipulative ability and (4) is capable of objective grading and standardization.

It may seem that the condition permitting objective grading and the one allowing for individual initiative are mutually exclusive. This has been the point of greatest difficulty in devising the present test and the means of grading it. The test and procedure finally evolved aim to meet both conditions.

The aim has been to have material that would test a wide range of material ages; that would give the minimum of familiarity, yet ample opportunity for building; and, finally, that would be so limited in amount that the time necessary to give the test would not be prohibitive. Each of these points was the subject of careful preliminary investigation, and the resulting was the selection of the test material shown in Plate I, and the adoption, as a time limit, of twice as many minutes as the child is years old. (In case of exceptional children twice the mental age is allowed.) In case the structure is completed in less time, and the child shows no interest in further building, he may be allowed to stop.

In giving the test the material is placed before the child, who is instructed in his native tongue, "to build the best thing he can and whatever he chooses." A number of children tire of building after a few minutes and accomplish little thereafter. In such cases the best attempt is the first or second. Usually the merit of the second or third structure started is the highest and in very few cases would added time for building result in securing structures of greater merit. Ten minutes for a five-year old is ample time, forty minutes for an adult or twenty-year old may be a trifle short, but by that time enough has been built to judge of the probable merit of the structure which would have resulted with slightly more time. With boys fourteen years of age the best structure built has usually been completed by the expiration of twenty-two minutes, so that twenty-eight minutes seems an

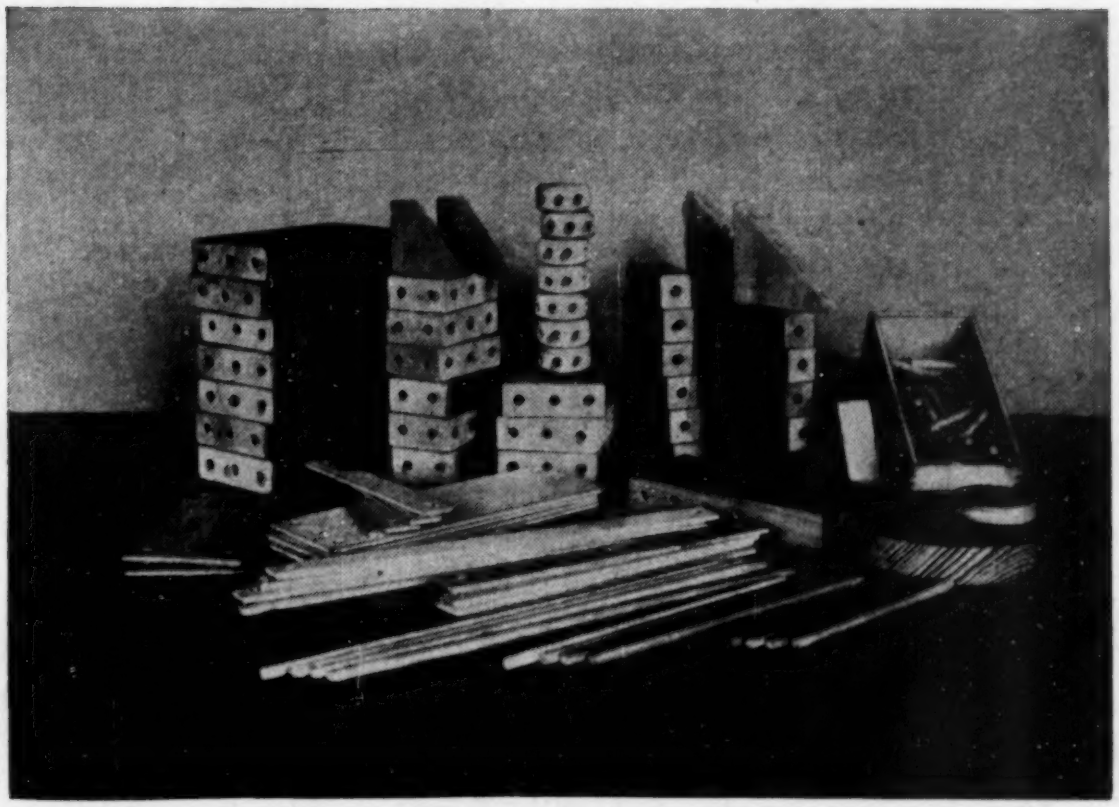

PLATE I. TEST MATERIAL

ample maximum time. Structures that are incomplete because of lack of material are not to be graded as high as structures incomplete because of lack of time. The former incompleteness is due to poor judgment in not recognizing the limitations of the material, while the latter may be due to the complexity of the structure conceived. In general the latter situation will arise only when an elaborate structure is started near the end of the allotted time, for the material is too limited to permit of many structures of such complexity that they cannot be built in the time allowed even to a ten-year old child.

The record blank for the test is shown in Plate II. Under "History" is to be entered notes obtained from the child as to blocks and building outfits that he has owned or played with extensively in the past and as to vocational or manual training experience that might be expected to have elements that would transfer to the test situation. The time of starting the test is recorded immediately following the word "time." As soon as the first structure started is completed or abandoned the time is

PLATE II.

Date.....

Name..... Age..... Date of birth..... Grade.....

History

Time					Final time
Purpose	1.	2.	3.	4.	5.
Dominance of purpose					
Symmetry					
Interest in building (b), or playing (p)					
Merit					
Is structure complete?					

Notes: (What is lacking, etc.).....

.....

Examiner.....

RECORD SHEET

recorded at the top of column 1. Sixty seconds after giving the child the blocks he is asked what he is going to build and his answer recorded opposite "purpose." If the child sticks to his original intention until his structure is complete or until the time expires he is graded high in the space left for "Dominance of purpose." The following words, or numbers corresponding, may be used in the grading: excellent = 5, good = 4, fair or average = 3, poor = 2, very poor = 1, no purpose = 0. The symmetry of the structure is graded using the same scale, no discernible symmetry equaling zero. Simple structures that give little opportunity for a symmetry, such as wagons, are generally to be graded "average" or "3." In the space left for interest is to be placed "b" or "p," according as the child is interested in building or playing aimlessly with the blocks. The large wheel shown in Plate I has been included in the material for the sake of having something that serves as a distraction from building and suggests playing. It does not lend itself readily to appropriate use with the other material, though, as Plate VIII shows it may be used with very excellent results. The merit of the structure built is determined by comparing it with stereoscopic photographs of structures which have been carefully graded, as will be explained. In the bottom space of the first column is recorded the child's statement as to whether or not his design is complete. As many columns 1, 2, 3, 4, 5, are used as there are attempts at building. It seldom happens that more than five columns are needed for a test. Notes as to causes of incompleteness of structures, attitudes of the child toward the work, his interests, his fixed ideas inhibiting variation and richness of conception, his dexterity, and his type of imagination are recorded in the foot-note or on the back of the record sheet.

The most important, because the most defective, element in the record is the grading of the product for merit as a structure indicative of constructive ability. In order to grade such varied structures a scale of forty stereoscopic photographs has been worked out. Ten judges have contributed to the evaluation of the merit of the elements of the scale. Two students and the writer ranked 250 photographs of structures built by normal and subnormal boys. From this number 54 were selected on the basis of their location in the entire series and given to eight judges, members of the education and engineering faculties of the Uni-

versity of Texas, to rank. The percentage of judges ranking one structure (stereoscopic photograph) above another determined the distance apart in the scale of the two structures. The general method followed in making these calculations is not here described, but is the same as that used by Thorndike in deriving his handwriting scale.[1]

From this scale of 54 samples certain ones were dropped because they were types of structures not needed in the part of the scale corresponding to their values. The resulting scale consists of 19 samples of buildings of various sorts, mostly houses, 12 of vehicles, and 9 of machinery, including aeroplanes and the like. The reliability of the scale is high. The grades given to the samples would correlate with other scale values, derived in a similar manner from the judgments of other equally competent judges to the extent of .98.

The probable error of judgment when a single judge grades a single structure is approximately 6 of the scale units, which is about $\frac{1}{16}$ of the range covered by the scale. Expressed in another way, the correlation between an individual's placement of a large number of samples and the true placement in the scale is .92. Practice in grading as few as 40 or 50 samples materially increases the accuracy of grading, decreasing the probable error of judgment by as much as one-half.

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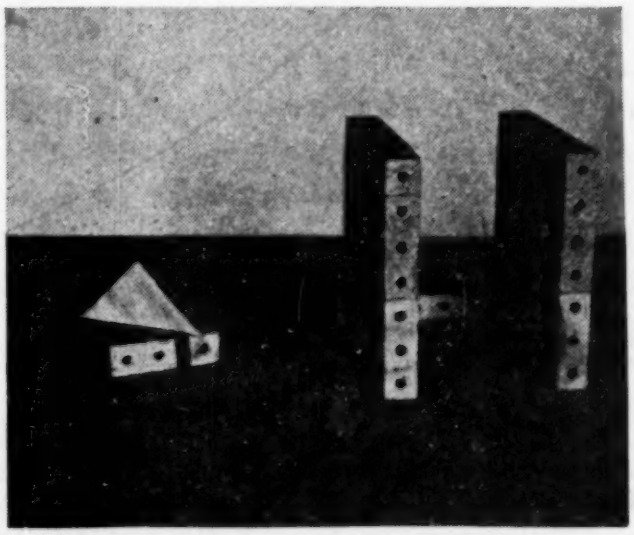
[1] EDWARD L. THORNDIKE. *Handwriting.* Teachers College Record, Vol. XI, No. 2, March, 1910.

A minor variation from Thorndike's method is in the weighting and averaging of various measures of difference. If $a, b, c, d, e, f, g, h, i$ represent samples in decreasing order of merit the distance between samples e and f may be calculated in nine different ways considering the neighboring four better samples a, b, c, d and the four poorer g, h, i, j. The percentage of judges ranking e above f gives one such measure of difference $D_{e\text{-}f}$. The percentage ranking d above f gives the difference $D_{d\text{-}f}$ and the percentage ranking d above e gives the difference $D_{d\text{-}e}$. $D_{d\text{-}f} - D_{d\text{-}e} = D_{e\text{-}f}$. In a similar manner seven other values of $D_{e\text{-}f}$ may be obtained. The probable errors of these differences were calculated taking, as a sample the rankings of twenty structures located near the middle of the scale and found to be proportionate to the numbers given below:

					Weights
P. E. of $D_{e\text{-}f}$			=	.1916	5
" " " $D_{d\text{-}f} - D_{d\text{-}e}$	or of	$D_{e\text{-}g} - D_{f\text{-}g}$	=	.3152	3
" " " $D_{c\text{-}f} - D_{c\text{-}e}$	" "	$D_{e\text{-}h} - D_{f\text{-}h}$	=	.4092	$2\frac{1}{3}$
" " " $D_{b\text{-}f} - D_{b\text{-}e}$	" "	$D_{e\text{-}i} - D_{f\text{-}i}$	=	.4740	2
" " " $D_{a\text{-}f} - D_{a\text{-}e}$	" "	$D_{e\text{-}j} - D_{f\text{-}j}$	=	.5034	1.9

These nine ways of calculating the single difference ($D_{e\text{-}f}$) were averaged, after first weighting as shown, inversely as their probable errors, to give the scale measure separating the samples e and f.

The lowest structure in the scale was originally intended to be a structure of zero value. It was obtained by tumbling the blocks out of a box and selecting the combination that looked most like a structure of some sort. In reality it required no ability to build, but since it looks as though it might be something it seems to have a little accidental merit. It accordingly is not graded zero, but 2, which is the writer's judgment of the distance it lies above a structure of genuine zero merit. This sample is the only one actually built by a boy. Plate III shows it and the one next higher in the scale. Having the scale it then became necessary to establish norms that results might be interpreted intelligently. In doing this the question immediately arose as to whether past experience of various sorts would lead to greater proficiency with the test material.



NO NAME, MERIT 2. HOUSE, MERIT 14

PLATE III.

Thirty-seven children, selected because of experience with metal building outfits, Tinker-Toy blocks, or in manual training, showed an average superiority of nearly a year, at age 14, above children not so experienced. Substantially all of this difference was contributed by children having had, or taking, manual training. There was no evidence that experience with metal building outfits and Tinker Toy blocks helped in the Constructive Ability test. As it is reasonable to think that those who take manual training in the high school are a group selected in large part because of their interest and former ability along

mechanical lines there is no certain, or even probable, evidence that success in the test is not determined solely by native interest and ability. Considering alone the group who had had or were taking manual training it is evident from the data at hand that they stand nearly two scale units above other high school boys of the same age. From *a priori* grounds, based upon similarity of function there seems less reason to think that elements in manual training work would transfer to the test situation than would elements from play with metal and Tinker Toy outfits. As there is no evidence of transfer in the latter case it is added evidence that the difference mentioned, of two scale units, is due to the selection of a group natively more capable along mechanical lines and not due to training. Because of these considerations the norms so far as at present drawn up are based upon the records of all boys examined and not of those only who had had no preceding experience in manual training. Approximately one-quarter of the fourteen year old group were taking manual training when tested. It is not popularly thought that high-school boys are superior to non-high-school boys in mechanical ability. If, however, their constructive ability should differ from that of boys in general the norms here given would on that account be those of a select group.

Three groups of school children, proclaimed "normal" by the principal, were tested, giving the following results:

36 boys, avg. age	8.08,	built structures of an avg. merit of	44.9, P. E. of avg. = 1.23
33	"	"	"	12.05,	"	"	"	"	"	"	"	"	58.0 P. E. of avg. = 1.39
33	"	"	"	14.23,	"	"	"	"	"	"	"	"	60.8 P. E. of avg. = 1.47

Boys of ages eight and twelve were chosen to give points for the upper limits of imbecility and moronity, while the age 14 was chosen to carry the scale into the higher ages. The three points shown by stars on Plate IV are the points thus experimentally determined. The curve shown was drawn through these three points to give norms for other ages. It, of course, is an approximation, to be supplanted by actual test records as soon as they are available. The three points determined have considerable reliability as their small probable errors indicate. These three

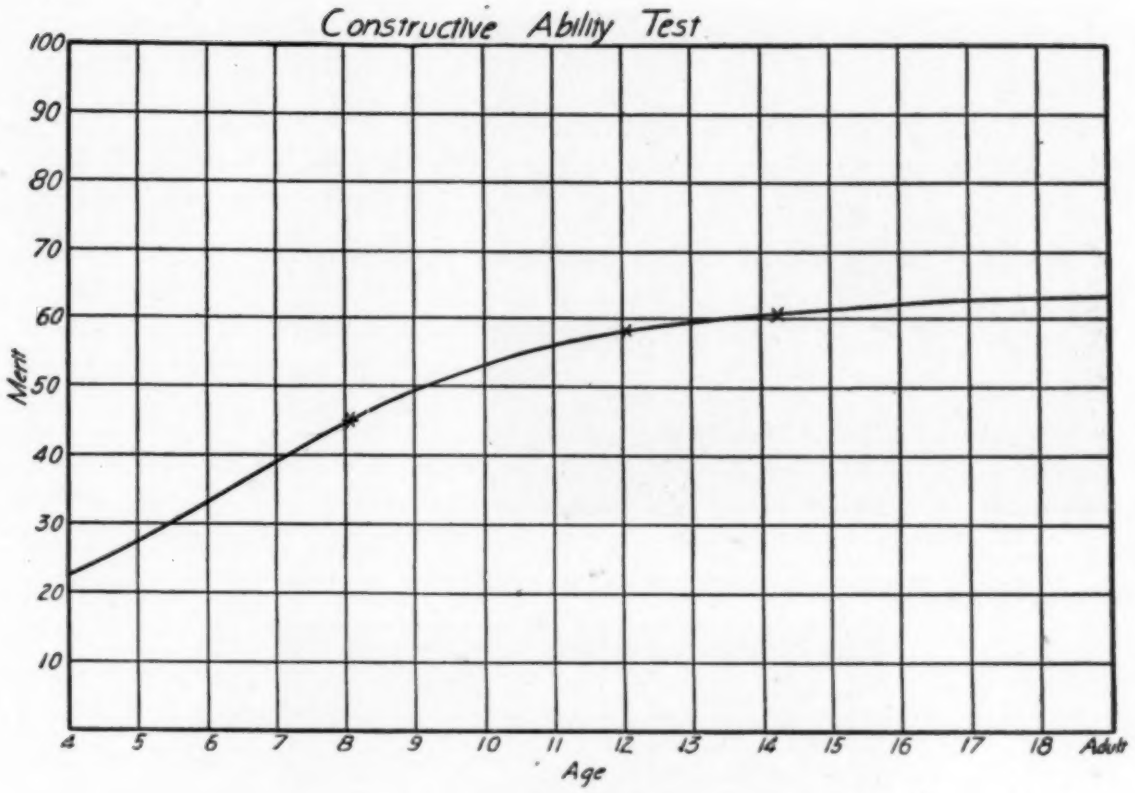


PLATE IV.

points are sufficient strongly to indicate a curve of the type generally found in the development of intellectual capacities. It is a typical growth curve with the greater part of the increase coming before adolescence. The points at which the curve cuts the ordinates for the different ages give the tentative norms for these ages. These values are given in the following table:

Age	4	5	6	7	8	9	10	11
Mean merit in constructive Ability test	22.4	27.6	32.9	38.8	44.4	49.2	52.9	55.8

Age	12	13	14	15	16	17	18	Adult
Mean merit in constructive Ability test	58.0	59.5	60.5	61.3	62.0	62.6	63.1	63.4

The probable deviation of a normal boy's record from the average for his age is about 7.5 units; 7 for 8-year olds and 8 for 14-year olds. It may be expected that the mean grades given for ages four to six and seventeen to adult, are the least reliable.

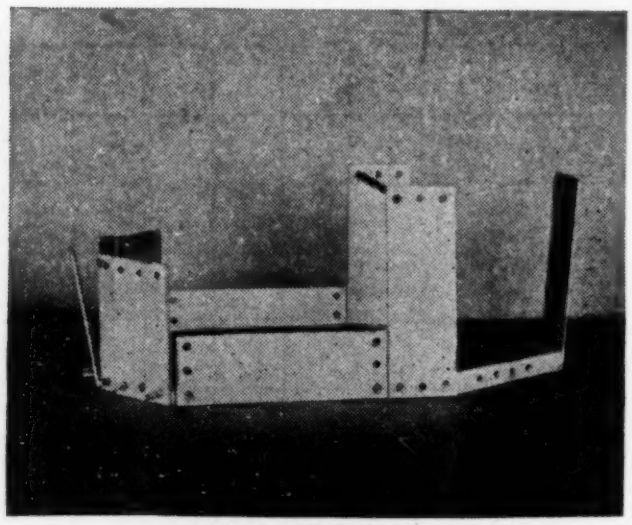


PLATE V, MERIT 46.

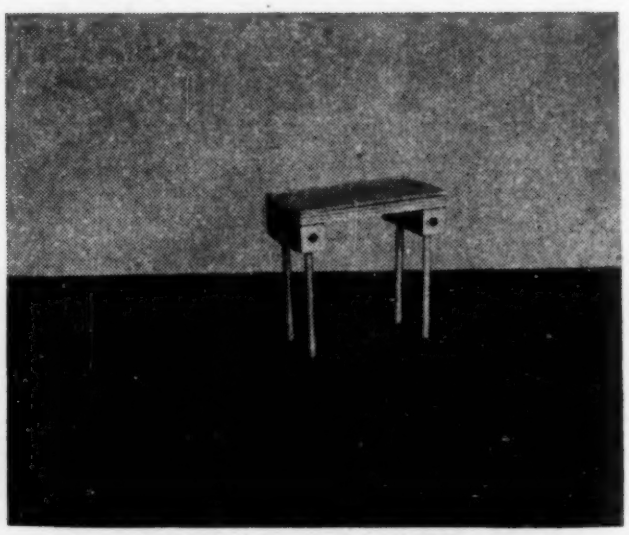


PLATE VI. TABLE, MERIT 57.

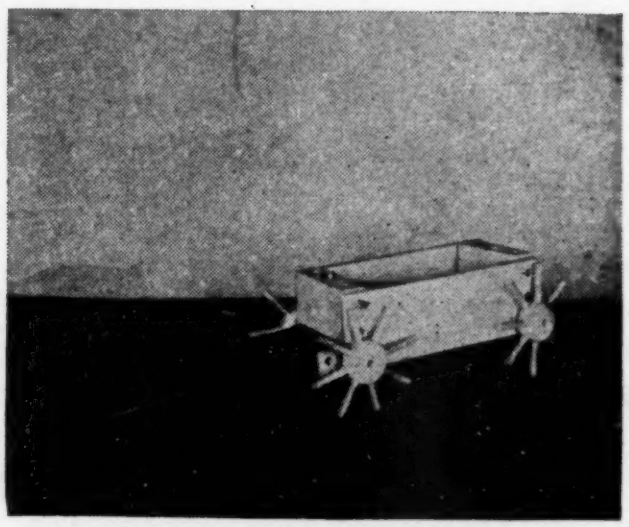


PLATE VII. WAGON, MERIT 61.

Plates V, VI, and VII show the samples in the scale which are closest to the average merits of normal eight, twelve and fourteen-year-old boys. Plate VIII is the scale sample of greatest merit. It is of such worth that structures as good as it may be expected about once out of every 60 built by normal fourteen-year-old boys.

As an illustration of the use of the test and scale, mention may be made of an examination of 250 of the boys in the Texas State Juvenile Training School for delinquent boys. In addition to the idiosyncrasies revealed, the average capacity of the boys was found to be very much less than that of normal boys of the same ages. These boys, of average age 15.26, showed an average accomplishment equal to that of the normal 9.5 year old. The average merit of the structures built by these boys is 51.3, approximately represented by Plate IX. As evidence that the test is highly correlated with mentality it may be reported that these boys showed nearly as great backwardness in such other mental tests as Binet and completion tests.

In addition to difference in merit of structures built the test reveals material qualitative differences. Questioning the boy when building as to what different parts of the structures are for, enables the experimenter to discover much as to the mental processes involved. Young children are prone to build skeleton or incomplete structures and supplement their shortcomings by an active imagination. A house such as that shown in Plate X is typical. With a young child the imagination is rich enough to be adequate for all needs and there is no feeling of incompleteness as to the structure. An older boy would be likely to observe that you would get rained on if you lived in that house. Another characteristic of the products of young children is that their buildings are usually representations of things as they are statically—their ideas frequently do not involve the idea of motion; for example, such a child built the wagon shown in Plate XI, with wheels pegged to the body and incapable of movement. The structure is a wagon without a doubt; for does it not have wheels and a body of a sort? The refusal of the wheels to turn need only worry an unfortunate adult who has not sufficient mental versatility to adjust such minor details.

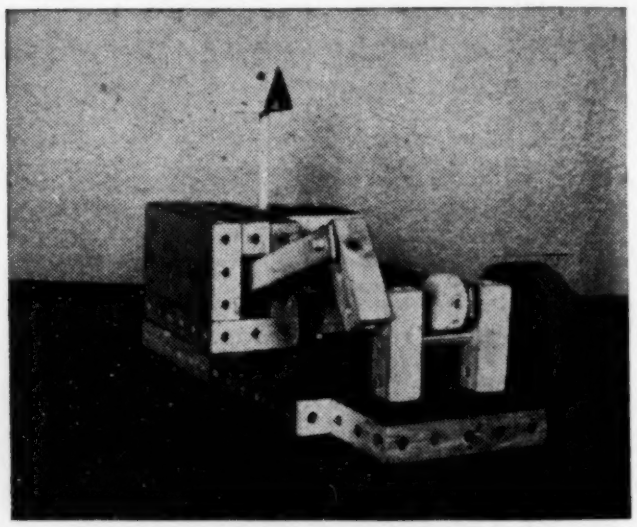


PLATE VIII. STEAM ENGINE, MERIT 93.

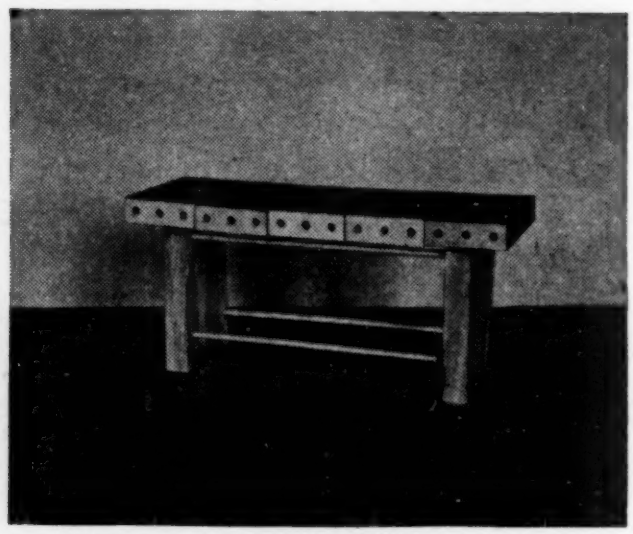


PLATE IX.

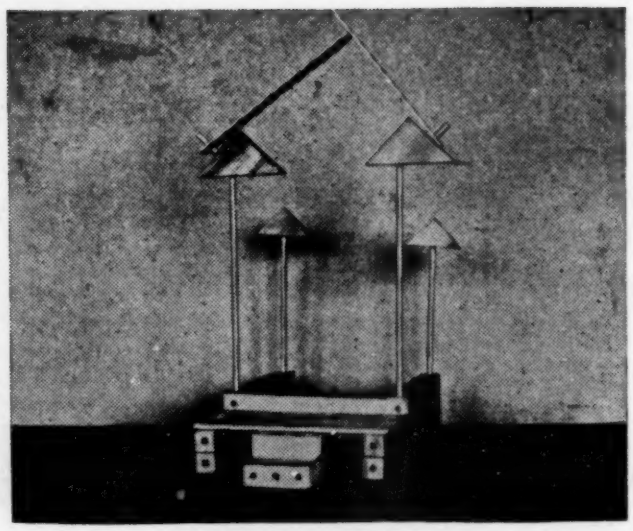


PLATE X. HOUSE.

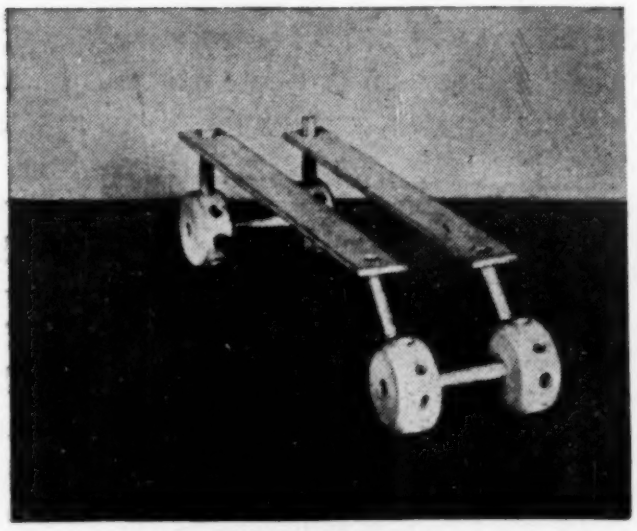


PLATE XI. WAGON.

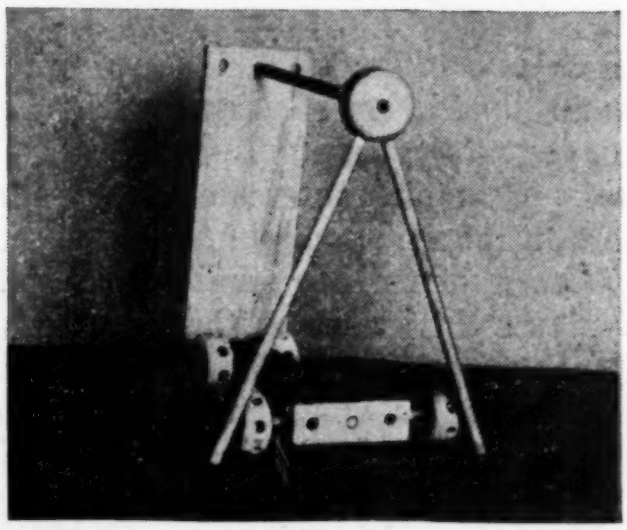


PLATE XII. BROKEN AUTO IN A GARAGE.

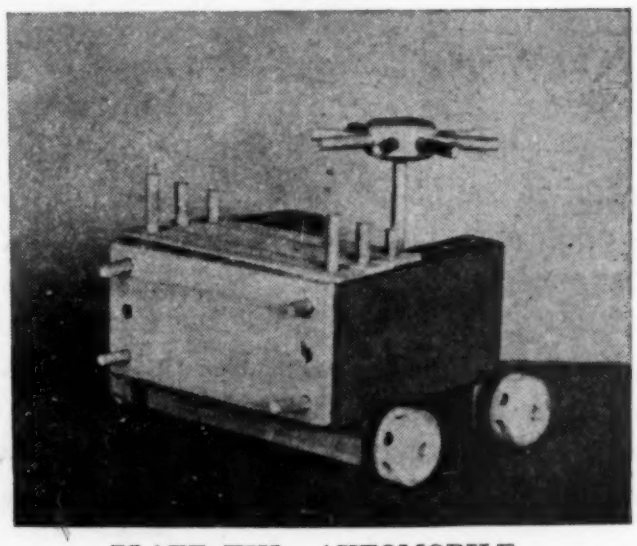


PLATE XIII. AUTOMOBILE

Plate XII, showing a "Broken auto in a garage" was built by a small boy who very prettily gave evidence of several typically childish tendencies. The garage and the automobile are mere skeleton structures, withal quite sufficient to serve as nuclei for fancy to add to. The idea that an automobile is meant to move did not occur to the boy, for it was not until pointed out to him that he saw that it was too big to go into the door of the garage, but at this point a truly liberal imagination came to the rescue for, in reply to the question, "how does the automobile get into the garage," he nonchalantly lifted the garage up and said "Oh, you just put it down that way," replacing it over the automobile.

Plate XIII is an automobile, as any child can prove, since it has wheels, a hood and a steering wheel. True the location of the steering wheel upon the rear axle might be considered slightly unique if one were to stop and think about it, but such reflection is quite unnecessary.

Plate XIV is an illustration of very good manipulative ability coupled with inadequate conceptual processes. The boy started to build a house. Becoming interested in the long rods, beams and wheels he continued to ramble on, building solidly and symmetrically. Lack of further similar material stopped him. When asked to name the structure there was some hesitation—his original intention apparently having been nearly forgotten. After a brief conflict as to whether it should be a house or a bridge he cut the Gordian knot and satisfied all demands by calling it a "house-bridge." It seems evident that this boy worked entirely devoid of ultimate purpose, though quite rigidly imposing upon himself the immediate purpose of making the structure symmetrical. Plenty of other material was available, but he "had to" stop for lack of wheels, rods and beams.

At an older age structures are very likely to be things that work—the wheels of wagons are on axles. Great care may be taken in building an aeroplane that the seat of the aeronaut is so enclosed "that the wind will not sweep him off as his machine rushes through the air."

Plate XV shows a racing automobile, built by an adolescent boy. The wheels turn, the gasoline tank is pegged on, but, keeping in mind that this machine is to travel at great speed it is apparent that the top part of the hood, due to its momentum,

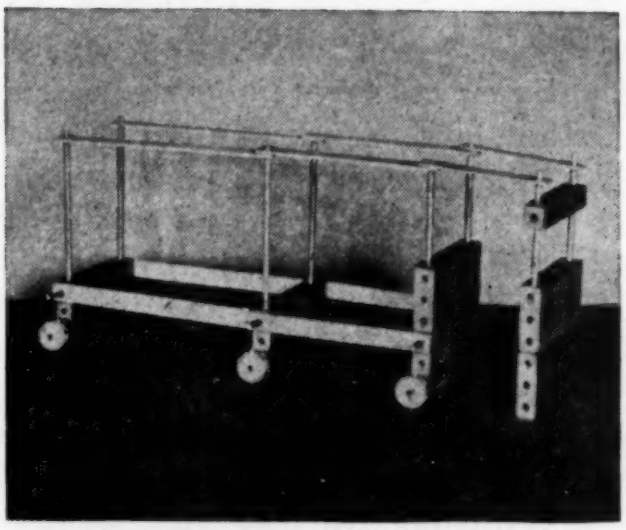


PLATE XIV. HOUSE-BRIDGE.

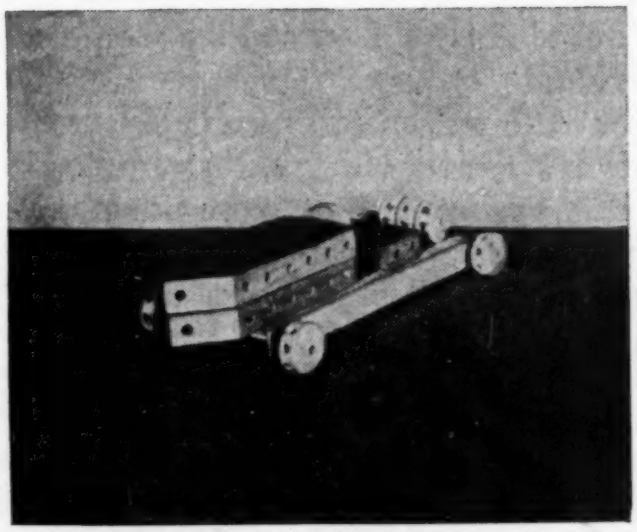


PLATE XV. AUTOMOBILE.

will fly off from the bottom in taking a sharp turn. The impossibility of pegging the two parts of the hood together to obviate this difficulty was the cause of much worry on the boy's part. The mental processes at work in the building of this racing car were entirely different from those resulting in the preceding five structures. In the main the building of adolescents is of this latter type. Eight year old boys build structures of both types, sometimes of neither, and frequently combine the elements of both in one. The discovery of spontaneous mental processes is one of the most fascinating and, withal, valuable results of the test. The interests of the children, their persistence, the mental restrictions they place upon their own procedure, and their feelings of satisfaction or exasperation with the results of their labors, can hardly be expressed in standardized objective terms, but they are all traits that the test enables the experimenter to observe.

Any number of problems are suggested by the test—the determination of sex differences; the correlation, expressed in terms of coefficients of correlation between the measures of the function here tested and other mental tests; the correlation between success in the test and vocational fitness, etc., etc. The test is particularly applicable in examining children of very different environments, for the trait measured is a creative and executive one, but slightly influenced by the ordinary past training of an individual.

For the present the writer will personally handle the material involved in this test. He will greatly appreciate records from other experimenters using it, that more adequate norms may be rapidly built up and that the test may be used more intelligently in the diagnosis of the innate fitness of youths to engage in mechanical vocations.

AGE NORMS OF PSYCHO-MOTOR CAPACITY[1]

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The time will come, I believe, when no one will be so rash as to attempt a scientific evaluation or classification of the varying degrees of human mental capacity simply from a general acquaintance with the subject, or from impressions gained from a brief conversation with him, or merely from observation of his conduct, or from an inspection of his physiognomy, or from the observation of the so-called stigmata of degeneration, or from an examination for physical defects or diseases, or from an inquiry into facts of personal and family history and into the circumstances of the social and physical habitat, or from an investigation of the subject's pedagogical record.

I do not wish to be understood as minimizing the value of such inquiries, and particularly the need of wide experience, in the work of mental and educational diagnosis. Certainly very few requirements are more essential to correct diagnosis, whether medical, psychological, educational or social, than extensive first-hand experience with many mental, educational and social types. Nevertheless so far as concerns the adequate estimation of *mental* capacity, whether native or acquired, there is probably no method of investigation which will take equal rank with the method of direct psychological experimentation—that is, the study of the mental reactions of the individual by control devices. Of course, it is clear that all psychological methods of studying another's mind are always indirect and inferential—based upon the examination of the products of mental application rather than the underlying processes themselves—but the study of mental processes by methods other than psychological is doubly indirect and inferential, and therefore proportionately unreliable. It is also clear that sometimes the only method of psychological examination available is the method of inspection or observation.

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[1] Delivered before the American Psychological Association, and Section H of the American Association for the Advancement of Science, University of California, August 5, 1915.

This method is by no means valueless. It may be made of considerable value for mental diagnosis, when the observations are numerous and accurate and when they are based upon the individual's behavior under normal social and industrial conditions. And yet it remains a fact that the psychological methods of determining mental capacity cannot be made scientifically precise without the use of control tests or accurate instruments, nor can the results be accurately evaluated without the use of various kinds of normal age-norms of mental development. The present discussion will be restricted to a statement of what is meant by age-norms of psycho-motor development and to a brief presentation of a few of the more important results from an experimental investigation based on the modified Seguinian form board.[1]

By a normal age norm of psycho-motor capacity is meant the average quantitative or qualitative, or combined quantitative-qualitative score made by normal children or adults of a given chronological age when they are incited to put forth their best efforts to execute a series of motor reactions required in the solution of a problem which demands, first, the motor ability to perform the appropriate muscular movements, and, second, the ability to make the basic intellectual analyses and comparisons on the accuracy of which depends the ability to make the correct muscular responses. When the ability to perform a motor reaction test depends primarily upon the subject's neuro-muscular or motor strength, speed or steadiness or upon his delicacy of motor coordination, and only incidentally upon his capacity for rapid and accurate intellectual analysis and adaptation, the test in question may be designated simply a *motor* test. On the other hand, a test may be classified as a *psycho-motor* test when it puts a premium upon the capacity for sensory discrimination, analysis and recognition, upon the ability to make a considerable number of associations and to retain the relationships between the various associations, upon the ability to make adaptations to a novel situation of considerable complexity, and upon the ability to execute a set of appropriate muscular movements. While it is impossible to draw an absolutely fixed and sharp line between these two kinds of tests, it is evident that, as above defined, a psycho-

[1] A complete exposition of the experiment will be found in my *Psycho-Motor Norms for Practical Diagnosis: A Study of the Form Board, Based on the Records of 4072 Normal and Abnormal Boys and Girls, with Yearly and Half-Yearly Norms.*

motor test is more valuable than a motor test for the purpose of grading a child's degree of mental development, for in addition to measuring motor ability as well as can be done by a motor test it also measures intelligence—*i. e.*, the individual's capacity to adjust himself to a novel situation.

One of the simplest and best tests of psycho-motor capacity is the modernized and improved type of form-board which was used by Seguin in the training of the feeble-minded.[3] In order to perform this test the subject must be able to distinguish the shapes of ten different detached insets, he must be able to associate the solid forms with the corresponding recesses in the board, he must be able to memorize the locations of the recesses if he is to improve satisfactorily as a result of repetition, he must be able to grasp, convey, and insert the insets quickly and accurately, and throughout he is required to adjust himself to a situation which may be quite or wholly unfamiliar to him.

The following are a few of the conclusions reached from an analysis of the form-board records of over 4000 bright, average, dull, feeble-minded, and epileptic children.

First, there is an increase in psycho-motor capacity as measured by this test for every age investigated from two to seventeen (see the Graphs). This disproves the statement that there is no improvement after the age of 12 or 14. Moreover, there is every indication that the development of psycho-motor capacity continues to increase beyond the age of 17—how far no one has determined.

Second, it is feasible to establish not only whole-yearly (Graph I), but also half-yearly (Graph II)[4] normal norms of psycho-motor development for all of these ages. But a closer analysis of the data indicates that the size of the steps between the successive age norms should differ according to the age of the subjects. The yearly steps are too large in the lower ages. It is advisable to utilize semi-yearly norms up to about the age of 8. From about 8 to 12 yearly norms and from 12 to 17 bi-yearly

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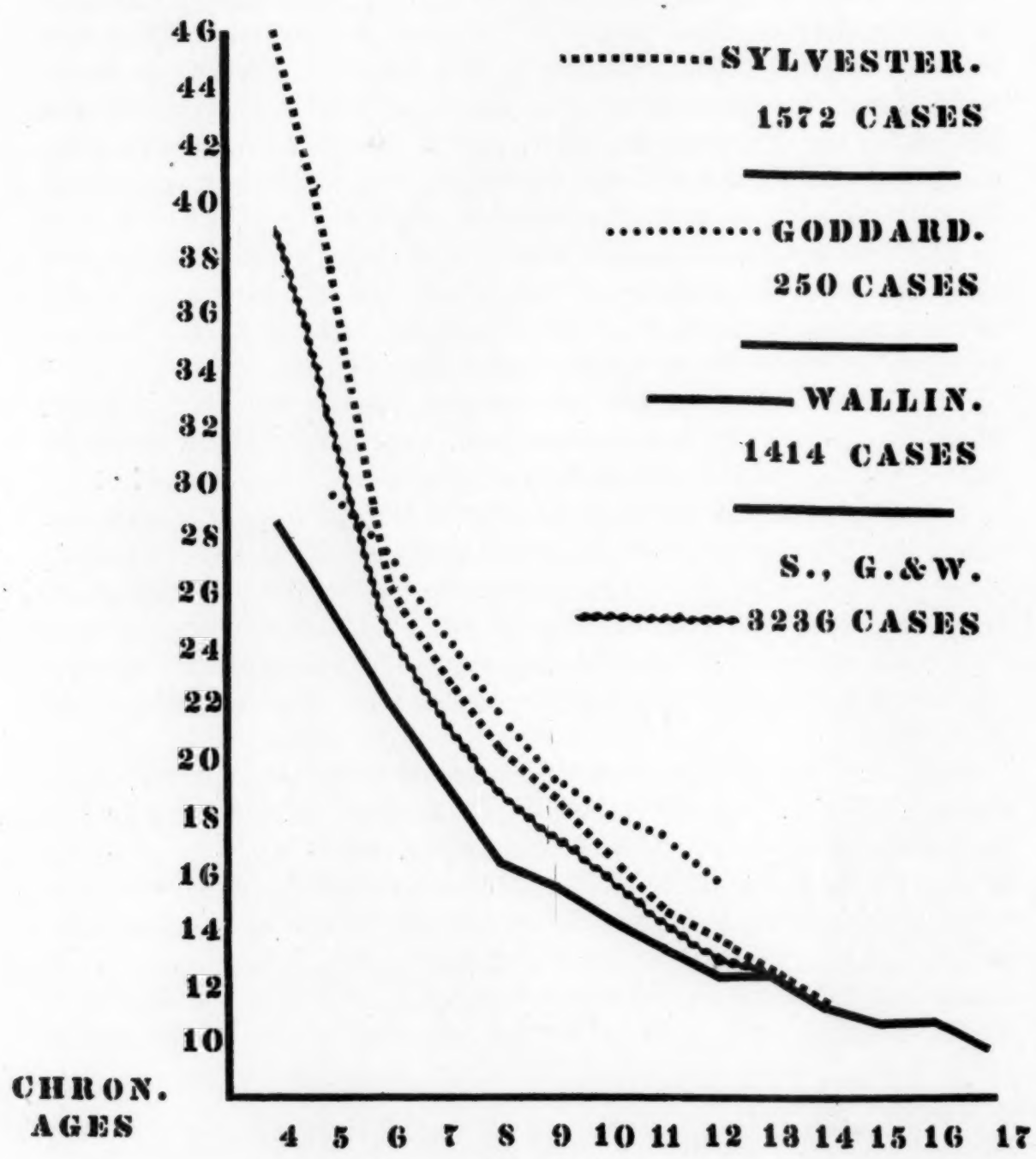
[3] Number 78,002 in Stoelting's Catalogue.

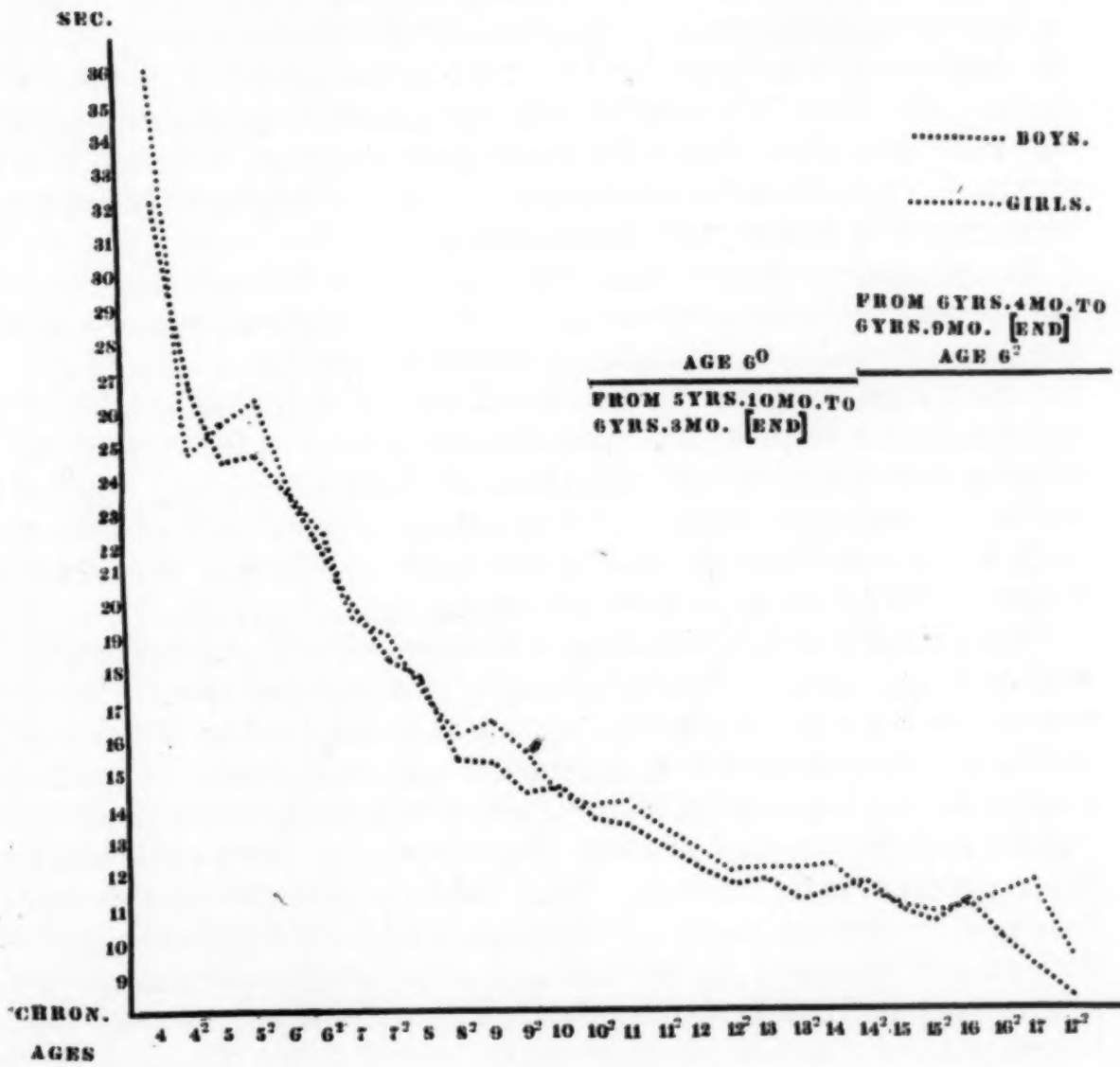
[4] The half-yearly norms are so constructed that no child will vary more than three months from his age classification. Thus age 6 includes children from 5 years 10 months (beginning of tenth month) to 6 years 3 months (end of third month). Age 6½ includes those coming within 6 years 4 months to 6 years 9 months (*The Mental Health of the School Child*, 110 f). The curves in both graphs are based on the averages of the best record in three trials.


YEARLY FORM BOARD NORMS
FOR NORMAL CHILDREN
SEC.
46
44
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
CHRON. AGES
4 5 6 7 8 9 10 11 12 13 14 15 16 17
SYLVESTER.
1572 CASES
GODDARD.
250 CASES
WALLIN.
1414 CASES
S., G.&W.
3236 CASES

GRAPH I.

HALF-YEARLY FORM BOARD NORMS.

BASED ON 722 NORMAL BOYS AND 758 NORMAL GIRLS.



GRAPH II.

norms seem to be sufficiently fine (no data are available after age 17).

Third, graded scales of intellectual or motor development can be most satisfactorily constructed in accordance with the principle underlying our motor scale. That is, semi-yearly, yearly and bi-yearly[5] norms should be established separately for numerous individual traits. The lower end of the scale for each trait should be based on the performance of children so young or immature that they can just barely do the test in question. At the upper end the scale should be extended so as to include individuals so old or mature that an increase in chronological age fails to evince any additional improvement. Comprehensive scales may then be constructed by assembling age norms for a considerable variety of mental traits.

Fourth, psycho-motor capacity varies with the grade of intelligence and the type of the subject. The bright children surpass the average children, the average surpass the dull or backward, the backward surpass the feeble-minded, the higher grades of feeble-minded surpass the lower grades, and the feeble-minded surpass the epileptic. Of all types of children studied by the writer the epileptic respond the most slowly, not only in motor tests but also in various intelligence tests.[6] Epilepsy is characterized by marked psycho-motor retardation.

Fifth, in view of the demonstrated dependence of psycho-motor ability upon degree of intelligence it is suggested that normal norms can only be secured by testing selected groups of normal children. Norms based on unselected groups would in all probability be too low, owing to the fact, indicated by both psychological and pedagogical studies, that there are more subnormal than supernormal children. The writer's normal norms are based on a selected group of children of whom 75% were classified as average, and about one-half each of the remainder as bright and dull. My feeling is that normal norms should be based on a distribution of ability which would give approximately 75% of normal or average children, 12.5% above normal and 12.5% below normal. The objection to this basis or similar

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[5] The steps may, of course, be smaller in the lower end of the scale and larger in the upper end.

[6] Only a portion of the supporting evidence has thus far appeared in print: *Experimental Studies of Mental Defectives*, 1912, 67ff.

bases of selection, *viz.*, that one year of mental deficiency or excess does not signify the same thing for a young child as for an older child, while true, seems to me to be irrelevant. When we designate a child of 3 and a child of 12 as equally above normal we do not imply that they are both advanced by the same absolute unit, say 3 years. Relatively one year of advance at 3 may be just the same as 3 years at 12. But this has no bearing on our predetermined basis of selection. The weakest point about that is the difficulty accurately to select our cases in advance of the testing, as it presupposes the existence of fairly accurate standards of judging at least three categories of ability, but it seems to me necessary to adopt a more definite standard of selection than that of random sampling, *i. e.*, the testing of unselected groups. If the child is in school the school criteria, though far from accurate, enable us to exclude the greatest variants.

Sixth, the differences between my normal age norms and the normal age norms of other investigators are surprisingly large (See Graph I). The average difference between my norms and Goddard's amounts to 4.4 sec. for ages 5 to 12, and between my norms and Sylvester's, 5.6 sec. for ages 4 to 12. It is evident that wholly discrepant diagnoses will be made according as the individual is rated by Goddard's, Sylvester's or my norms. Formerly when using Goddard's norms my clinic cases almost invariably ranked decidedly higher in psycho-motor age than in Binet-Simon age; now when gauged by my norms, and particularly when gauged by the combined Goddard-Sylvester-Wallin norms, the psycho-motor and Binet-Simon ages more nearly coincide; in fact the psycho-motor age is frequently less than the Binet-Simon age. This, I believe, is in accordance with expectation, for the form-board is certainly a better test of native intelligence than many tests included in the Binet-Simon scale.

The reasons for the large differences in the three investigations, aside from the few cases on which Goddard's results are based, may be, first, the fact that my subjects may have been incited to put forth greater effort, especially from the start; and, second, the probability that I tested relatively fewer dull pupils and relatively more bright ones than either of the two other investigators.

Seventh, boys are superior to girls in psycho-motor ability (See Graph II). The average scores for the normal boys are

higher than for the normal girls in nearly 75% of the comparisons. The boys' average superiority for each whole-year, based on the shortest scores in three trials, amounts to .61 sec. The boys' superiority, however, among the subnormal cases is not very obvious, possibly because of the larger number of subnormal boys than subnormal girls, particularly in the lower grades. The boys' superiority becomes somewhat more marked with increasing chronological age (though there are exceptions), possibly because the greater maturity of the girls compared with the boys of corresponding age grows less and less as they become older.

Eighth, properly to gauge psycho-motor capacity by the form-board it is advisable to give the test at least three times; first, because the average score improves from test to test; and, second, because the effect of repetition varies somewhat according to the intelligence, type, age, and sex of the subjects. Girls make a poorer initial attack than boys and, therefore, gain relatively more from repetition. Intelligent and more mature children make a better initial adjustment than less intelligent and younger children, and, therefore, improve less from repetition; and epileptics very frequently do poorer in the second or third trials than in the first. For these and other reasons the fairest single index by which to gauge the psycho-motor efficiency of an individual by this form-board is the best record in the three trials.

EFFICIENCY IN MENTAL MULTIPLICATION UNDER EXTREME FATIGUE[1]

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The Problem

In reporting the experiment of Miss Arai, in the course of which difficult problems in mental multiplication were performed without rest over an extended period of time, Thorndike points out the fallacy of assuming that to take twice as long to perform a given piece of work necessarily means a reduction of 50 per cent. in efficiency. He says: "The zero point of efficiency in the function of mental multiplication would be 'just not to multiply a number like 3 by a number like 2 in, say, ten minutes.' We do not of course know just at what point between this zero and the ability to multiply a four-place by a four-place number mentally in five minutes with only two figures in the answer wrong (as Miss Arai did at the beginning of work), we should place her ability, at the end of work, to multiply a four-place by a four-place number in eleven minutes."[2] And again he remarks: "With mental multiplication it would be practicable, though very laborious, to make the former measurement [*degree* of difficulty], by having interspersed in and at the close of a rigidly fixed long work-period of mental multiplication with two three-place numbers, tests in multiplying a four-place by a three-place number, a four-place by a four-place, five-place by a four-place, and a five-place by a five-place. There should also be tests with three-place by two-place, two-place by two-place, etc., in case an individual comes to fail utterly with the three-place by three-place multiplication."

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[1] This experiment was conducted at the summer session of Teachers College, Columbia University, 1914, under the immediate direction of Professor G. M. Whipple, of the University of Illinois, then in charge of certain courses in educational psychology at Teachers College. Professor Whipple is responsible for the general plan of the experiment and of this report upon it.

[2] *Educational Psychology*, 1914, Vol. III, p. 20.

It was this last proposal that furnished the cue for the present experiment. The problem set forth was: given an individual who has succeeded by practice in multiplying mentally a four-place number by a four-place number with fairly steady efficiency: if this individual then continues without rest at mental multiplication until he is totally unable to proceed further, will his efficiency come to an abrupt end, or will it 'tail off' by degrees, so that a three-place can be multiplied by a three-place number when four-place numbers become impossible, and so on until finally he can just barely multiply a one-place by a one-place number?

The Material

The digits 2 to 9, inclusive, were written singly on small cards. The cards were shuffled and the requisite number was then drawn to provide a multiplier and a multiplicand. The two numbers thus secured were written down and remained in sight until the experimenter had mentally performed the multiplication and written down the product. As soon as the elapsed time had been recorded, the cards were again shuffled and a new problem set. In the later stages of practice and in the final test, however, the problems were all made up beforehand, so that the mental work proceeded with no more interruption than was needed to record the answer and the elapsed time.

The Period of Practice

Mental multiplication is decidedly affected by practice improvement. To offset this source of error the experimenter worked at the task for one hour a day for fifteen days, almost invariably in the evening between nine and twelve o'clock. Approximately three days' time was given to each stage of practice—two place by two-place, two-place by three-place, and so on. The main results are shown herewith in Table I. It will be seen that at the 15th day the experimenter was doing fairly steady work with four-place by four-place numbers. Careful notes were kept of general physical condition, attitude toward the work, feelings of fatigue and similar conditioning factors. The chief trick of method that was developed was that of adding the partial products to one another as soon as they had been secured, in order to avoid the difficulty of holding more than two partial products in mind while computing the others.

The Final Test

The subjective conditions under which the final test was carried out are sufficiently important to warrant the reporting in full of the experimenter's notes. The objective record, scores for speed and errors, follow the personal account.

The final test was undertaken on Friday evening, August 7th. After a full week of hard mental work and a normal night's rest (11:45 P. M. till 7:00 A. M.) and a full day spent in reading experimental psychology, history of education and Dewey's *How We Think*, I began work at 11:00 P. M. Physically, I was in good condition for the test; that is, I was in usual health, without much sign of headache or eye-strain and tired enough to wish I might go to bed. Yet, I entered upon the test with some zest, determined to keep the work going as long as I could do so at all, and I suspected that this meant a rather long struggle, as it has not been my habit to drop a thing easily that I have determined to do.

I seated myself at my desk—where I had worked most of the afternoon and evening—and did not leave my place till I was no longer able to work. Beginning at 11:00 P. M., I worked continuously till after 3:07 A. M.—the last time recorded, and for some time later, but I was too worn out to record or to notice the exact time when I gave up the struggle.

As the work progressed I had a feeling that I was making good time and being fairly accurate. During the first hour I noticed little growth of fatigue. By the close of the second hour *bodily* weariness was weighing heavily, much more so than mental weariness, but I felt I could continue some time longer.

The feeling of interest in the experiment did not wane so long as I was able to get and hold products reasonably. As real interest waned during the third hour, I prodded myself mentally and took more interest in my intellectual condition than in the mere matter of fatigue. My growing inability to banish from memory previous partial products and to hold the new ones that I wanted, inability to speed up, greater and greater length of time necessarily spent in repeating partial products and sums, loss of memory so as to have to start problems over, etc., were all very prominent mental states.

There was no feeling of wishing it were over, so I might rest, but more of lethargy. The keen feeling of bodily discomfort slowly disappeared, but the consciousness of physical heaviness increased.

Sleepiness became an issue during the last half of the second and first part of the third hour. This state passed and did not return. Early in the third hour inability readily to leave a completed problem and begin another became more and more noticeable. I was conscious of this and tried to overcome the growing tendency to secure a rest period by merely repeating either the completed product or the time just recorded. As the sleepy stage passed away, I began to feel short of breath, and to breathe more and more heavily, and at times seemed unable to continue till I had taken one or two long deep breaths. These became more frequent, till at the end of the experiment about every fourth or fifth breath was of that sort. It was some twenty minutes after I quit work before I could breathe normally.

Near 2:30 I seemed to have about reached my limit. I became interested in a new study of my mental condition. I felt a little like two people—one trying to multiply and the other sitting by and looking on. The work proceeded slowly, laboriously and almost aimlessly. The mental activities seemed to be so little under voluntary control; my inability to stop doing or repeating one thing or even to remember at times the partial product I had just secured became so marked that I began to question the effect of the experiment on my sanity. At 2:35 I decided that if I could finish the problem I was then working, I would drop to a four-times-three or a three-times-three. I did finish it and after writing the result, recorded the time. I then lost all conscious grasp. A few minutes later my wife entered the room and found me, she said, aimlessly repeating the time I had shortly before recorded. Her smothered laugh attracted my attention, and I determined to show her that I could still solve four-times-four's. I did succeed in solving another problem in what proved to be sixteen minutes and thirty seconds. I was scarcely able to hold myself upright in my chair.

Feeling my inability to solve another four-times-four I thought to lighten the task, so turned to a three-times-three. I worked at the first one for some time. I tried to arouse myself by winding my watch, but did not succeed in getting even the first partial

product. My wife noted the time and aided me in getting to bed. Alone, I should have scarcely gotten to bed, unless something had happened to shock me. That might have served the purpose.

TABLE I.

Condensed Results for the Practice Period

Date	Digits in Multipled.	Digits in Multiplier	Problems Solved in 60 min.	Total Wrong Figures in Answers	Time in Sec. Quickest	Time in Sec. Slowest
July 21	2	2	46	14		
" 22	2	2	73	12		
" 23	3	2	29	9		
" 24	3	2	42	16		
" 26	3	3	16	7		
" 27	3	3	15	11		
" 28	3	3	19	10		
" 30	4	3	13	20	120	475
" 31	4	3	11	15	180	490
Aug. 1	4	3	13	9	220	425
July 29	4	4	7	2	300	800
Aug. 3	4	4	9	20	310	570
" 4	4	4	9	22	240	595
" 5	4	4	9	22	275	695

TABLE II.

Final Test. Aug. 7. Mental Multiplication of 4-place by 4-place Numbers. Time 11:00 P. M. to 3:07+ A. M.

No. of Problem	Time in Sec.	Wrong Figs. in Answers	No. of Problem	Time in Sec.	Wrong Figs. in Answers	No. of Problem	Time in Sec.	Wrong Figs. in Answers
1	315	0	11	395	1	21	785	4
2	255	1	12	445	2	22	1345	0
3	330	2	13	415	0	23	770	3
4	275	0	14	485	4	24	640	5
5	295	6	15	370	1	25	415	5
6	405	2	16	420	2	26	1465	1
7	390	1	17	370	0	27	800	1
8	565	1	18	390	3	28	900	3
9	310	0	19	320	4	29	∞	—
10	280	1	20	580	0			

Inspection of Table II shows in general a gradual rise in time per problem from the first to the eighth, a relatively steady period from the 11th to the 18th problem and a marked rise in the time

for the remaining problems. There appears to be no obvious correlation between the time and the accuracy scores.

Conclusions

From this single experiment it would, of course, be absurd to generalize concerning the course of mental work under extreme fatigue. However, the outcome suggests strongly that there exists a definite and relatively abruptly appearing point beyond which mental work becomes impossible. The experimenter feels that while possibly some tremendous reward or incentive might have enabled him to have continued for a brief time, the end of his capacity would have been postponed only for a few minutes at the most. So far as this experiment is concerned, in any event, when ability mentally to multiply a four-place by a four-place number had come to a stand-still as a result of extreme mental fatigue, ability mentally to multiply any number by any other number was also lost. In fact, in the judgment of the experimenter, though no tests were made upon this point, ability to do anything that could properly be termed mental work was lost as well.

AN EXPERIMENT ON THE INFLUENCE OF TRAINING ON MEMORY

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A review of the theoretical discussions of the subject of "transfer of training" leaves one with a well defined impression that habits are essentially specific but that, theoretically, a specific habit may be formed, the stimulus of which is a factor so common to immense groups of situations that in its practical effect it is a general habit. Among such general stimuli are found ideals, useful systems of attack on different sorts of problems, and any general concept which modifies our manner of dealing with concrete situations.

The experimenters, on the other hand, seem to have taken no direct account of these habits, general in their effect. They have either considered them *a priori* as necessarily by-products of the formation of a habit highly specific in its effect or as habits impossible to form, according to their personal bias on the question of "transfer of training." It is clear that any such habit as that of crossing a particular letter when seen on a printed page, tossing up one ball and preparing to catch another at sight of the descending ball or imaging the Engish equivalent when some foreign word is seen would be a highly specific habit the stimulus to which would be common to few situations. Some experimental investigation as to just how common to situations a factor may be and still serve as an adequate stimulus for the formation of a habit might help to clear the theoretical discussion on the subject of "transfer of training." If a habit could be formed with a very common factor as stimulus then we would have at command the mechanism for a process in all practical effects the equivalent of "transfer of training" with no theoretical complications to explain. On the other hand the failure of such experiments as crossing letters and teaching children to write neat arithmetic papers to show any effect of transfer may be explained by the failure of any such common stimulus habit to develop as a by-product during the formation of a habit involving a response to a unique stimulus.

The following is the account of an attempt to set up in a number of children a habit involving a stimulus which is common to very many situations where memory functions, and to test its efficacy in such situations.

A vocabulary, an amount of prose or poetry, the multiplication table or any such material to be memorized offers to the learner a more or less homogeneous mass of units which he must isolate in pairs or groups and attend to until each unit is firmly associated with at least one other unit in the mass. This isolation process is more definite in the matter of a vocabulary than in learning prose but, though the shifting of attention from group to group is more rapid in the case of the prose each word must be held in the focus of attention with another word at least once and usually several times before the prose is learned. An individual with a habit of reacting to any homogeneous mass of material with some such definite process of isolation of pairs or groups might conceivably memorize the mass more readily than one who had no such habit. Such a habit might, it seems, fairly be termed a "habit of attention" and the following means was devised as a possible method for forming a "habit of attention."

Twenty sets of slips seven and one eighth by five and five eighths inches in size were prepared. Each slip had printed on it thirty-two two-syllable English words. The words were arranged on the slip in irregular order and the twenty sets differed in that the arrangement of the words on the slips was unique for each of the twenty sets. Different words were also used in each set. Twenty sets of slips were similarly prepared using nonsense syllables instead of words. Below are specimens of both the word and the syllable slips.

sif bos doz hiv paj kiz
giq lih luk qel dup
jil dek xaq jin quc
teh zef heq zes teq
kul goj fiz reh zoz
qeh zab foy yez bok sab

money portrait account credit
balance payment hundred counter
against contract bargain control
outline profit coinage balsam
copy unite coquette cordon
currents cornet revise printer
correct shifter cutlet something
paying express curtain wrapper

The subjects to be trained in the "habit of attention" were presented once a day with one of these slips. For five minutes the subjects were asked to isolate the units (words or syllables) in pairs and attend to these pairs. The subjects were asked *not* to try to learn the units and never to use in combination two units which were adjacent in any direction. The latter was a precaution against the formation of mechanical systems of isolation. They were also told not to try to associate words or syllables which were alike or which had any reason for being associated. It was made as clear as possible that the only thing they were to do was to isolate these units and attend to them in pairs. They were told to do this as often as possible in the time allowed them and to use as many different combinations as they could. They were asked to make on a paper provided for the purpose a straight mark for each combination they attended to. This was mainly for the purpose of holding their attention to the work and as there was no possible check on their reliability the number of these marks was taken as a general rather than as an accurate index of the number of combinations made. At the end of five minutes the papers and slips were taken up. A record was kept of the number of marks each subject made each day. The twenty sets of words were used first and following that the twenty sets of nonsense syllables. Eight times (four while the words and four while the syllables were being used) the subjects were unexpectedly asked to write all the words or syllables they could think of after the slips had been collected. This work with the words and syllables constituted the training series.

It may be urged that even here the stimulus was not a "mass of homogeneous material" but a number of words and again a number of syllables. This objection could be urged against any material when the subject was not specifically told to regard the material only as a mass of homogeneous material. My subjects were children and I doubted their ability to follow such verbal instruction profitably. By using two different sorts of material during the training series and by stressing the emphasis on the isolation of the combination of units as the important factor in the procedure I attempted to shape the conditions of the experiment so that the stimulus to which they reacted should be in effect a "mass of homogeneous material." As a check on

my control of this factor I used yet another entirely different sort of material in the test series the description of which follows.

Before the training series began a test was given based on the old fashioned game of memory played at children's parties. Thirty-two ordinary objects picked up about the house were spread on a small table. Each subject was asked to stand for two minutes in front of the table memorizing the objects and then go to another room and write the names of as many of the objects as she could remember. This test was repeated with a new set of objects at the end of the series with words and again at the end of the series with syllables. It was like the training series in that it presented a homogeneous mass of thirty-two units to the subjects. It was unlike the training series in that the subjects were asked to learn these units while during the training series they were only asked to attend to the units in pairs. The following is a list of the objects used in one of the table tests.

Pink stationery box	Glove buttoner
Letter	Picture hanger
Bundle of wire	Paintbrush
File	Button hook
Box of matches	Perfume bottle
Red Cross adhesive plaster box	Sponge
Framed photograph	Lens of eyeglasses
Memorandum book	Hairpin
Eyeglass case	Bodkin
Prayer book	Small grey box
Spoon	Penknife
Candle	Brown box
Powder box	Ink bottle
Scissors	Pin
Candle stick	Drinking cup
Pen	Magazine

A second type of test was given which merely involved ordinary memorizing as it is done in the schools. The subjects were given slips of paper with paragraphs of prose printed on them and told to memorize the prose. They were allowed five minutes in which to do this and then the slips were taken from them and they were asked to write what they could of the prose. One such test was given before the training series began and another, with prose of approximately the same length and difficulty, was given after the training series was entirely over. Below are the two prose selections used.

I

ROBIN HOOD AND HIS MERRY MEN

Lend a courteous ear, all ye that be of gentle birth, while I tell you of a bold outlaw whose name was Robin Hood. The best archer was he that ever drew a bow in Merry England. In the famous town of Locksley hard by the great forest of Sherwood, he was born and nurtured, and there he dwelt until he had seen some fourteen summers. Of noble birth he was and should have been an earl; for his father was a Norman knight, Robert, Earl of Huntington, his mother a noble Saxon lady.

But in the wars between King Henry and his sons, Earl Robert took arms against the king; and it was so that when the king won the victory in the year of grace 1147, Earl Robert was taken captive and soon after beheaded as a traitor to his lord the king. Moreover the king proclaimed Robert, the Earl's only son "a wolf's head;" that is, an outlaw whom any man might slay without fear of the law, and gave his inheritance to his uncle, the proud bishop at St. Mary's, and his cousin, the high sheriff of Nottingham, for they had taken the king's side against his sons.

II

PEREDUR, THE SON OF EVRAWC

The next day Peredur went forth by the high road, along a mountain-bridge, and he saw a valley of a circular form, the confines of which were rocky and wooded. And the flat part of the valley was in meadows, and there were fields betwixt the meadows and the wood. And in the bosom of the wood he saw large black houses of uncouth workmanship. And he dismounted, and led his horse towards the wood. And a little way within the wood he saw a rocky ledge, along which the road lay. And upon the ledge was a lion bound by a chain, and sleeping. And beneath the lion he saw a deep pit of immense size, full of the bones of men and animals. And Peredur drew his sword and struck the lion, so that he fell into the mouth of the pit and hung there by the chain; and with a second blow he struck the chain and broke it, and the lion fell into the pit; and Peredur led his horse over the rocky ledge, until he came into the valley. And in the center of the valley he saw a fair castle, and he went towards it.

The kind co-operation of President B. V. [illegible]. Dixon and Miss Sue Gillean, Instructor in the Newcomb High School, made it possible for me to use as subjects in this experiment two sections of Class B in the Newcomb High School. They were girls from eleven to thirteen years old. It so happens that at Miss Gillean's request I had previously tested these children for imagery type and the sections had been formed on that basis making one section of ten auditory-motor children and one of eight visual children. This was done to facilitate the emphasis on imagery type in teaching. When I gave my preliminary table test to the two sections I found that the visual section did better at it than the auditory motor section, which seemed natural, and on that account I chose the auditory motor section for the section to give the training series to and reserved the visual section as a check section which should take only the test series. The ten auditory motor children were fairly regular in their attendance,—only one dropping out of school toward the last. Out of the visual section, however, there were only four who took both the first and the last test series. The first test was given November 18, 1914, and the last test May 18, 1915. The results for both the training series and the test series follow.

TABLE I.

Number of marks indicating combinations made during five minutes training with words and syllables.

	Words							
Subject	Nov. 25	Nov. 30	Dec. 1	Dec. 2	Dec. 3	Dec. 4	Dec. 7	Dec. 8
1	193	303	334	393	382	308	243	201
2	68	absent	85	160	208	230	270	228
3	71	128	165	328	305	300	379	419
4	105	119	183	202	229	240	264	284
5	83	110	102	134	172	192	200	185
6	67	128	218	185	251	282	298	276
7	176	216	165	324	332	264	243	293
8	76	119	136	231	266	255	239	256
9	absent	111	209	255	248	244	195	228
10	153	200	143	186	312	331	295	285

TABLE I. (*continued*)

	Words							
Subject	Dec. 9	Dec. 10	Dec. 11	Feb. 22	Feb. 24	Feb. 25	March 1	March 3
1	absent	185	219	240	240	187	184	232
2	absent	absent	198	221	194	165	181	173
3	380	313	297	497	163	301	215	250
4	226	210	272	295	167	258	244	214
5	152	192	92	239	203	155	absent	158
6	226	214	233	333	146	335	374	215
7	208	217	258	259	227	173	222	241
8	221	240	257	293	248	179	215	224
9	237	279	278	236	203	207	261	261
10	168	199	241	119	175	181	166	absent

TABLE I. (*continued*)

	Words				Number of words recalled during unexpected tests immediately after five minute training			
Subject	Mar. 5	Mar. 8	Mar. 10	Mar. 11	Nov. 25	Dec. 7	Mar. 1	Mar. 11
1	223	242	194	210	6	8	8	11
2	absent	185	158	171	14	12	10	11
3	205	241	486	242	8	5	11	10
4	269	261	252	239	10	10	11	9
5	263	162	185	223	12	8	absent	6
6	340	327	284	285	15	17	17	15
7	251	269	137	233	12	12	11	14
8	220	254	174	206	9	5	8	7
9	absent	176	231	203	absent	8	12	7
10	266	180	185	242	9	7	4	9

TABLE I. (*continued*)

	Syllables							
Subject	Mar. 17	Mar. 18	Mar. 22	Mar. 24	Mar. 25	Mar. 25	Mar. 29	Mar. 31
1	absent	145	132	204	186	284	168	
2	139	218	224	absent	absent	absent	absent	
3	371	295	358	213	309	357	246	
4	151	276	215	238	185	219	212	
5	105	165	119	116	185	150	131	
6	149	225	351	146	151	171	135	
7	59	178	absent	154	139	182	absent	
8	168	162	57	76	73	133	103	
9	203	128	229	185	180	306	106	
10	128	174	141	148	162	187	240	

TABLE I. (*Continued*)

	Syllables							
Subject	April 1	April 5	April 8	April 12	April 14	April 15	April 19	April 21
1	215	251	150	265	181	168	95	155
2	absent	absent	absent	absent	absent	absent	absent	absent
3	absent	290	259	329	276	185	219	246
4	201	234	208	247	208	195	227	284
5	164	absent	114	141	158	181	183	168
6	220	297	269	239	273	247	235	145
7	192	160	150	204	140	182	234	175
8	131	120	72	116	101	113	80	131
9	290	216	204	209	138	283	105	115
10	334	absent	304	296	259	absent	absent	absent

TABLE I. (*continued*)

	Syllables					Number of syllables recalled during unexpected tests immediately after five minutes training			
Subject	April 22	April 26	April 28	April 29	May 3	March 18	April 1	April 15	May 3
1	78	126	98	99	211	1	8	1	10
2	absent	absent	absent	absent	absent	1	absent	absent	absent
3	187	265	379	207	245	3	absent	4	4
4	236	256	300	218	256	2	9	7	8
5	106	226	229	183	198	5	6	4	5
6	136	222	135	328	419	9	17	13	10
7	195	193	301	196	absent	5	6	7	absent
8	102	108	116	89	115	1	4	1	6
9	97	208	187	125	221	1	6	0	7
10	absent	absent	absent	297	376	1	1	absent	3

TABLE II.

Table Tests

Percentage of objects recalled

	Test				Test		
Subject	1	2	3	Subject	1	2	3
1	53%	75%	87%	1	53%	69%	56%
2	34	59	absent	2	53	65	75
3	47	56	69	3	56	78	50
4	50	75	78	4	31	69	97
5	44	78	78	Average	48.25%	70.25%	69.5%
6	44	72	97				
7	53	72	72				
8	44	50	47				
9	47	59	69				
10	47	81	87				
Average	46.3%	67.7%	76%				

TABLE III.

Prose Tests

Percentage of correct words recalled in correct order

Subject	Test 1	2	Subject	Test 1	2
1	26%	32%	1	63%	63%
2	absent	absent	2	10	11
3	39	32	3	25	27
4	56	50	4	34	7
5	39	36	Average	33%	27%
6	41	75			
7	50	35			
8	33	28			
9	50	50			
10	6	8			
Average	37.77%	38.44%			

Both sections show a marked improvement in the record for the second table test over that for the first. But while the untrained section did slightly worse on the occasion of the last table test the trained section again made considerable improvement. There is also a distinct drop in the results of the second prose test from those of the first in the case of the untrained section. There is a slight corresponding rise in the records of the trained subjects. In view of the wide disparity between the type of work in the prose test and that in the training series this seems rather significant.

The subjects were so few and the time available with them so comparatively short that I hesitate to draw conclusions on the basis of these results. But they seem to indicate that at least there still remains the possibility of forming by direct means a habit which may be genuinely general in its effect. To my own infinite astonishment I seemed to have given these children a "habit of attention" which was useful to them in memorizing. At any rate from the evidence now at hand further experiments along this line need not necessarily be unprofitable.

The significance that this might have for the problem of transfer of training has already been noted. But the problem of "formal discipline" would not, I believe, be implicated because, to my mind, the rise of any habit as a response to a stimulus common to many situations in connection with any study would be accidental and unpredictable since the study is directly concerned only with the formation of habits with unique stimuli. In this event the possibility of forming a habit with a stimulus generally common would be no more directly related to the study of Latin than to the study of cooking.

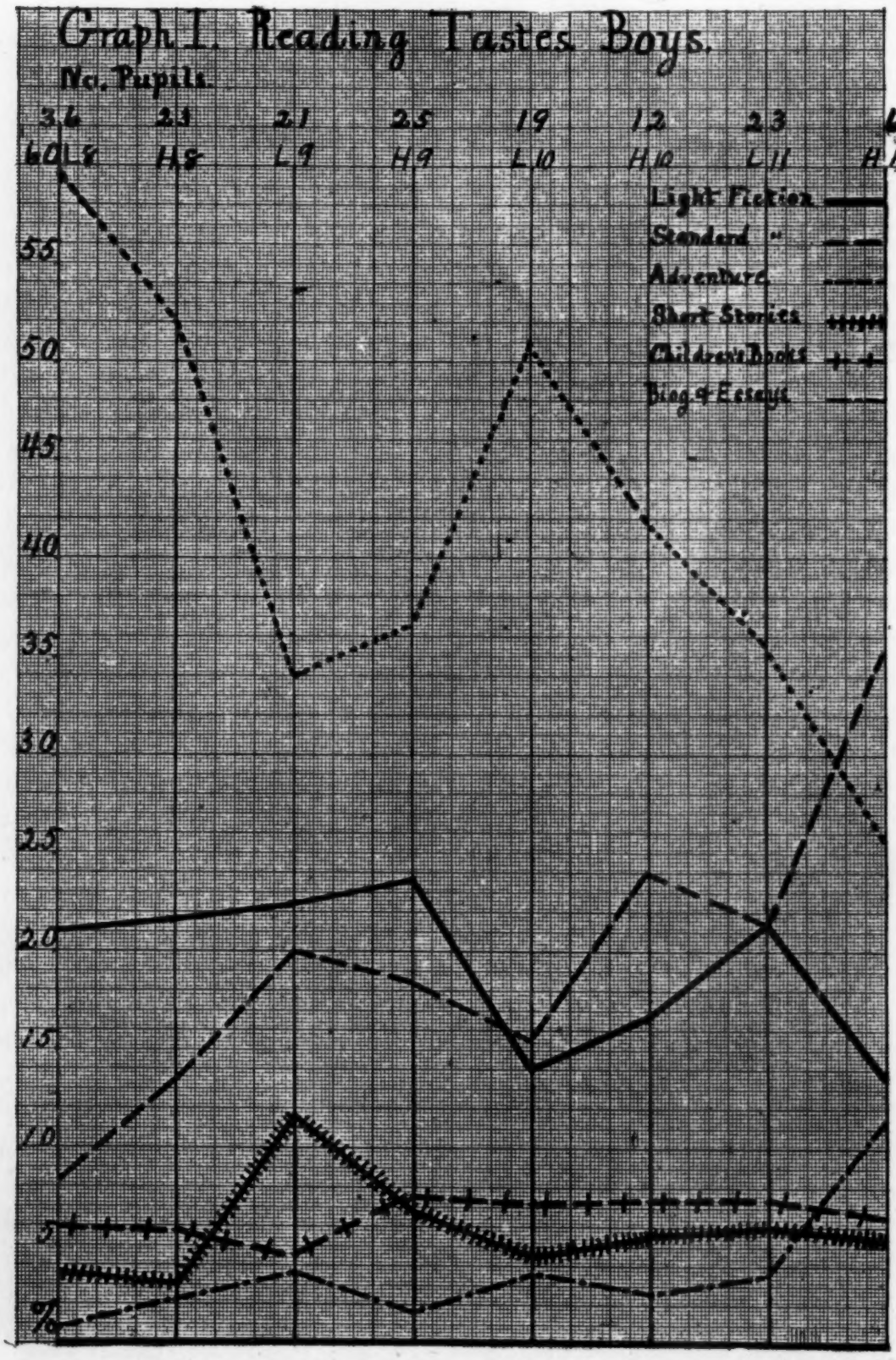
COMMUNICATIONS AND DISCUSSIONS

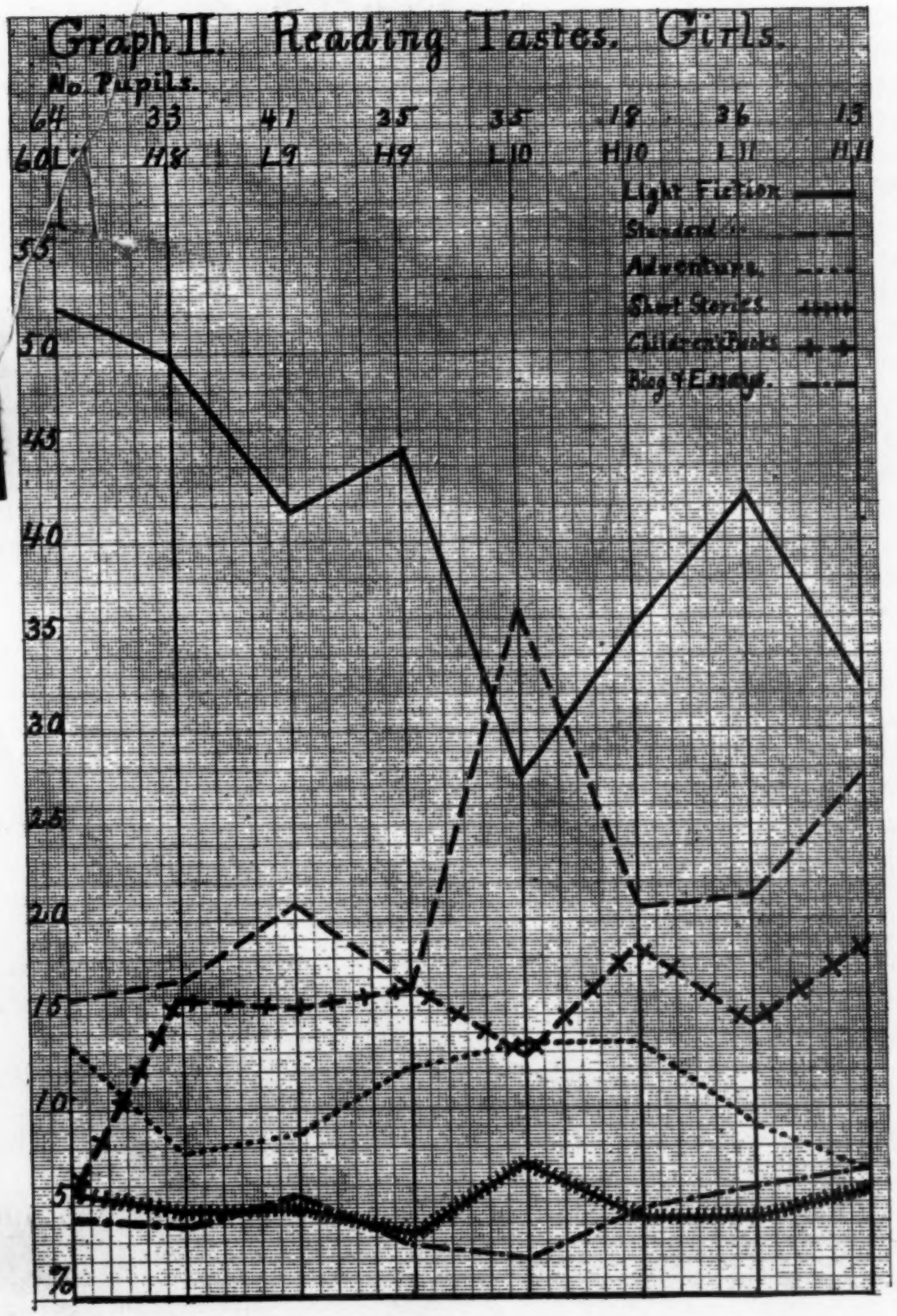
THE READING INTERESTS OF HIGH SCHOOL PUPILS

Contributons from the University of Texas Educational Laboratory No. 2

This paper presents the results of an attempt to ascertain what reading is done by high school pupils. In order to arrive at a basis for the investigation a preliminary list was first drawn up, including authors and works which it was thought young people would be likely to read. This list was submitted to a class of college freshmen with the request that they check all the works that they had read and indicate any other reading not found on the list. From these results a final list was prepared containing all the authors and all the separate works mentioned by as much as twenty per cent. of the students. This list contained the names of one hundred and ten authors, and seventy-nine of their books were listed specifically by title. Below the name of each author a space was left for the inclusion of other works than those mentioned, and at the end of the paper there were thirty-four blank spaces for an account of additional reading. To the left of the column of authors' names were three blank columns, in which the student was requested to indicate for each book whether the reading was done before the entrance to high school, or during the high school course, and whether the reading was required or not. To the right of the authors' names were six columns to indicate the degree of liking; that is, whether it was a favorite book, whether the reader liked it fairly well, disliked it, re-read it, would like to re-read it, or whether it was only partially read. In another column, the students were asked to indicate their reasons for liking or disliking the books.

These papers were distributed among the pupils of the Austin High School with the instructions that they were to be filled out and returned after an interval of two days. About sixty-five per cent. of those distributed were returned. Some of them were filled out fully, others only in part; a few had to be rejected on account of insufficient date. A total of four hundred and forty replies were finally included in the report, representing one hundred and sixty-five boys, and two hundred and seventy-five girls. The results for boys and girls were tabulated separately, and separate tabulations were made


Graph I. Reading Tastes. Boys.
No. Pupils.
34 23 21 25 19 12 23 6
L8 H8 L9 H9 L10 H10 L11 H11
Light Fiction
Standard "
Adventure
Short Stories
Children's Books
Biog. & Essays
60
55
50
45
40
35
30
25
20
15
10
5
%


Graph II. Reading Tastes. Girls.
No. Pupils.
64 33 41 35 35 18 36 13
60 H8 L9 H9 L10 H10 L11 H11
Light Fiction
Standard "
Adventure
Short Stories
Children's Books
Biog & Essays
55
50
45
40
35
30
25
20
15
10
5
0

for each half grade. The first study made deals with the amount and kind of voluntary reading which the pupils do during the high school period. Outside of required reading, very little poetry is read. Almost the only poets mentioned as having been voluntarily read were James Whitcomb Riley, and Eugene Field. For this reason poetry was omitted from the curves plotted to show the results of this study.

Reading was classified under nine heads: History, science, fairy stories, children's books, biography and essays, standard fiction, books of adventure, light fiction, and miscellaneous short stories. Three of these classes (history, science, and fairy stories) were so small that they are omitted from the graphs. On account of these omissions the total of the per cents for any graph shown on the graphs is somewhat less than one hundred.

Inspection of the graphs warrants the following conclusions:

1. With the girls, light fiction forms the largest part of voluntary reading. The general tendency is for this to decrease during the high school period, but a decided fall in the low tenth grade is followed by a rise in the high tenth and low eleventh.

2. With the boys books of adventure take the high place occupied by light fiction with the girls. On the other hand, books of adventure with the girls drop to practically the same position as that held by light fiction with the boys. The two classes of reading occupy reversed positions with the two sexes. With the boys the general tendency is for the popularity of books of adventure to decline in the higher grades; with the girls this tendency is less marked.

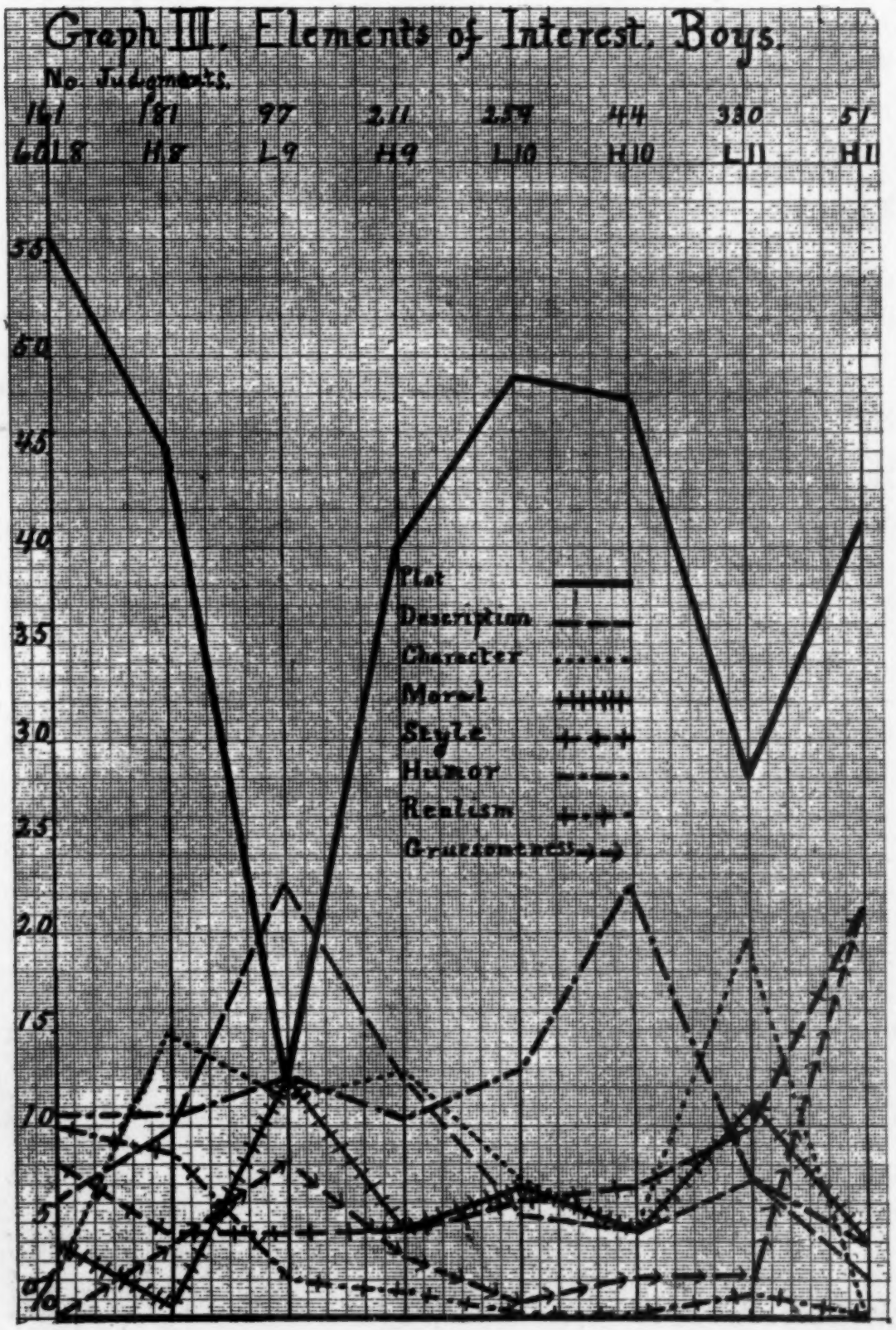
3. The interest in standard fiction increases with both boys and girls as we go up through the grades.

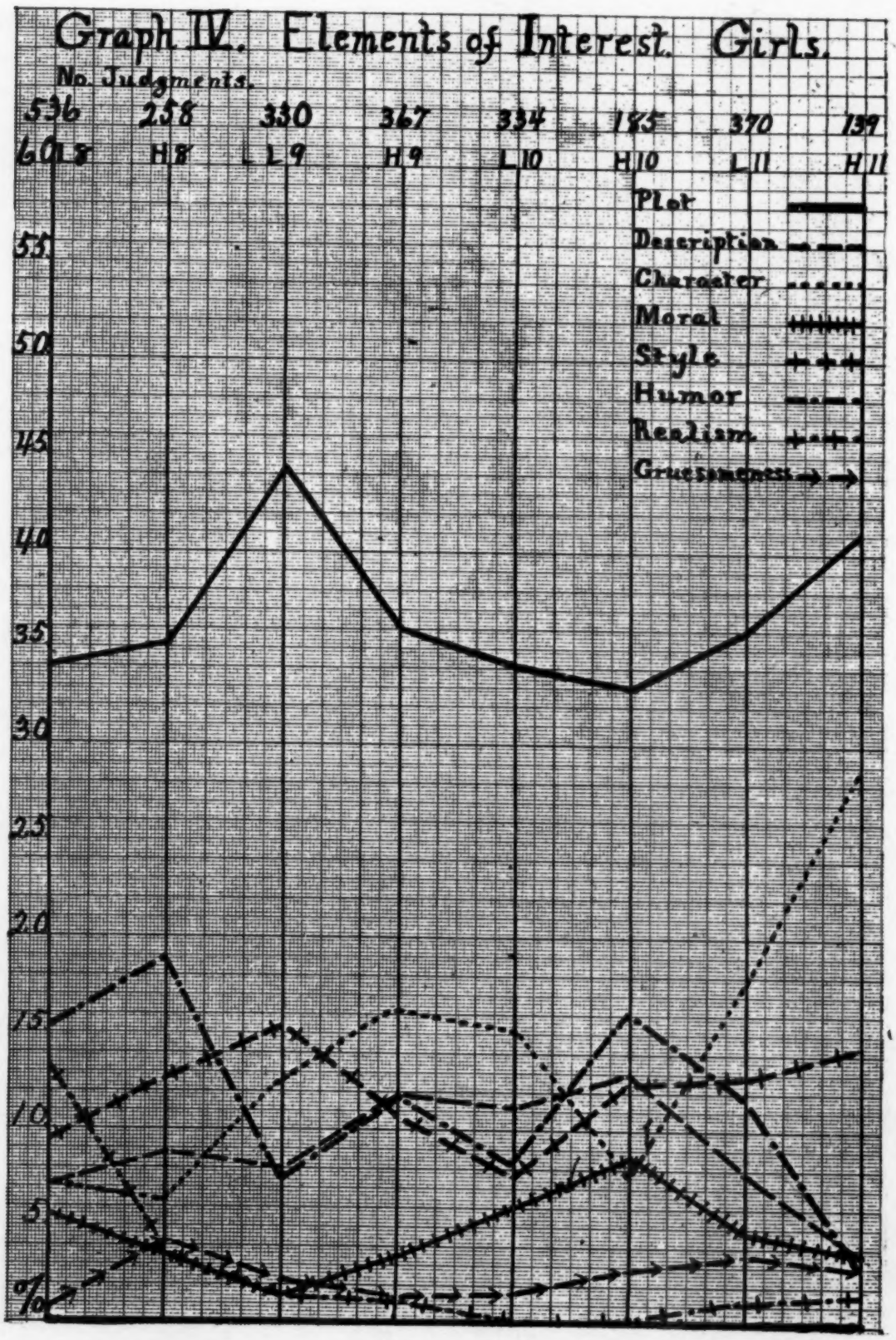
4. The short story does not hold as high a place as might be expected with either boys or girls. Its position remains fairly constant throughout the grades.

5. With the boys children's books take about equal rank with short stories. With the girls they are much more popular. Their popularity with the girls increases as we advance in the grades, while with the boys it remains about stationary.

6. Biography and essays show a slight increase in popularity with both boys and girls, but they do not take a high rank at any time.

A further study was made of the material from the point of view of the reasons given by the pupils for their likes and dislikes. Practically all reasons for liking books were classified under eleven elements


Graph III. Elements of Interest. Boys.
No. Judgments.
161
181
97
211
259
44
330
51
L8
H8
L9
H9
L10
H10
L11
H11
50
45
40
35
30
25
20
15
10
5
0%
Plot
Description
Character
Moral
Style
Humor
Realism
Grossness


Graph IV. Elements of Interest. Girls.
No. Judgments.
536 258 330 367 334 185 370 139
60 H8 L9 H9 L10 H10 L11 H11
55
50
45
40
35
30
25
20
15
10
5
%
Plot
Description
Character
Moral
Style
Humor
Realism
Grucsomeness

of interest: plot, character, description, moral, fancy, pathos, humor, historical interest, realism, style, and gruesomeness. Graphs three and four indicate the relative values of the more important of these elements of interest. Fancy, pathos and historical interest have been omitted from the graphs because of their infrequent occurrence.

From these graphs it will be seen that interest in plot takes the first place in all grades with the girls, and in all but one with the boys. Interest in character is irregular with both boys and girls; while that in description is fairly constant for girls, though decidedly irregular for boys. Interest in the moral element never rises very high among the girls. It begins in the low eighth at five and six-tenths per cent., drops steadily to the low ninth, rises gradually to the high tenth, and falls again. The average with the boys is higher, though in the high eighth this element of interest drops lower than in any grade among the girls. Humor ranks high with both boys and girls, and style is fairly high with the girls in every grade, but moderately low for the boys, except in the high eleventh, where it rises to a higher point than is reached in any grade by the girls. With both boys and girls interest in realism begins comparatively high, but drops constantly until the end of the high school. Interest in the gruesome is low with girls, and rises high with boys only in the low ninth and high eleventh grades.

J. Carleton Bell,
Itasca B. Sweet.

University of Texas.

THE

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EDITORIAL

PROGRESS IN EDUCATIONAL PSYCHOLOGY

The past year has been characterized by a steady and healthy increase in the amount of educational research produced in this country. Several new tests have been devised which promise to be of distinct value in mental diagnosis. Noteworthy among these is T. L. Kelley's Constructive Ability Test, an account of which appears in the present issue of this JOURNAL. In the standardization and further application of old tests good work has been done by Miss Hall of Albany, by Pyle of Missouri, by Pintner of Ohio, with the Knox Cube Test, by Wallin of St. Louis, with the form board, and by Mrs. Wooley of Cincinnati. The latter is rendering a particular service in establishing norms for adolescents who leave school to go to work, and is thus furnishing a basis for comparison between these young people and those who go on to high school.

In the field of tests of intelligence the Binet scale is undergoing extensive revision and reorganization on the basis of the elaborate

studies of Terman of Leland Stanford. The mass of data collected from the examination of over two thousand children with the old Binet tests and several supplementary ones has furnished material for a careful evaluation and placement of the individual tests, and has resulted in an entire re-arrangement of the upper portion of the scale. No user of the Binet scale can afford to ignore Terman's work, a detailed account of which is promised in a monograph to be published some time next summer.

The rapidity with which the Yerkes point scale is growing in favor has aroused some protest from old line Binet testers. It must be admitted that the individual tests of the point scale present nothing new, as they are taken almost bodily from the Binet list. The chief advantages of the point scale are its flexibility, allowing the introduction of new tests without destroying the validity of the old ones, and the substitution of norms derived from the study of special groups for the concept of mental age. In some respects the point scale would seem to offer a finer and more accurate measure of achievement than the Binet scale. What is urgently needed is a more careful qualitative study of individual tests in order to determine their significance and point value in relation to other tests.

In no field of educational research has there been greater activity during the past year than in devising scales for the measurement of attainments in school subjects, and in the application of these scales and standards of measurement to school children. This activity has been fostered by the spread of the school survey idea and by the demand on the part of school officials and others for more accurate knowledge of the accomplishment of pupils in school subjects. Among the contributions worthy of special mention are Freeman's and Gray's studies in handwriting, Childs' application of the Thorndike drawing scale, Rugg's scale for freehand lettering, Thorndike's studies in reading and the Kansas reading tests devised by F. J. Kelly, Ayres' spelling scale and Sackett's application of the Buckingham spelling scale to an entire school system, the Indiana coöperative studies in arithmetic, involving the use of the Courtis tests, and Starch's studiés in reading, writing, spelling, and grammar. It is remarkable that all these studies are limited to elementary school subjects, and that, with the exception of a preliminary investigation in algebra by Walter S. Monroe, nothing has been attempted in the high school field. In view of the unrest in secondary education scientific studies of the attainments of high school pupils are greatly needed.

J. C. B.

NOTES AND NEWS

The Bureau of Educational Measurements and Standards of the Emporia, Kansas, State Normal School is rendering excellent service by interesting superintendents and teachers in the use of educational tests and scales. Directions have been drawn up for the use of the Thorndike, Ayres, and Freeman handwriting scales, the Hillegas and the Ballou composition scales, the Courtis arithmetic tests, the Buckingham and the Ayres spelling scales, and other scales for the evaluation of school work. The Bureau has devised record sheets for tabulating the scores obtained from a class and has thus materially facilitated the use of the tests by school people. The Kansas Silent Reading Test, devised by Dr. F. J. Kelly, an account of which will appear in the February number of this JOURNAL, is meeting with great favor, and is being widely used by teachers and superintendents in Kansas and adjacent states. In Iowa, for example, it is proposed to standardize the work of school grades in reading by the general use of these tests, and an order has been given for 12,000 copies to be distributed to Iowa schools under the direction of the Dean of the School of Education at the University of Iowa.

Professor Lewis M. Terman of Stanford University has recently issued a "Condensed Guide for the Use of the Stanford Revision and Extension of the Binet-Simon Measuring Scale of Intelligence." This guide is based on tests of more than 2050 children and 300 adults. A complete guide is promised by June, 1916. In addition to the rearrangement of some of the tests, the most striking changes are a series of tests for the fourteenth year, the omission of tests for the fifteenth year, and two series of tests for adults, one for the average adult estimated at age sixteen, and the other for the superior adult at age eighteen. The guide presents detailed directions for giving the tests, tabulating the results, calculating mental age, determining the intelligence quotient, and interpreting the results. In the Stanford revision each year contains six tests, one for each two months up to the tenth year. After that it will be noted that there are tests for every other year, eight for the twelfth year, with a value of three months each; six for the fourteenth year, with a value of four months each; and six for each of the years sixteen and eighteen, with a value

of five and six months each respectively. The further use of this revision should furnish interesting data on mental testing.

Dr. David Spence Hill, Director of the Division of Educational Research, New Orleans Public Schools, has recently prepared for distribution to teachers an age-grade sheet, showing the status of each grade in each school for the entire city, with city averages and average deviation. The children of each grade are grouped in five divisions; those at or below age making usual or rapid progress, those at or below age making slow progress, those over age due to late entrance or lost time, those over age due to slow progress, and those repeating. It is perhaps the most elaborate statistical exhibit of the age-grade status of pupils that has ever been put in the hands of the teaching forces of a public school system.

The ninth annual convention of the National Society for the Promotion of Industrial Education will be held at Minneapolis, January 20 to 22. A feature of the meeting will be the report on the Minneapolis Industrial Survey, which has been participated in by the officials of the public school system, of the Dunwoody Institute, and by the Survey Committee of the Society. The survey has taken two main lines: a study of the schools with reference to the preparation afforded for industrial productiveness; and a study of the industries of the city with reference to the opportunities for boys and girls to obtain employment, and for the kind of training which may be afforded them.

Professor Hans Gross, whose death at the age of 68 has just been reported, was born December 26, 1847, in Graz, Austria, and was at the time of his death, professor in the university at that place. Gross was a man of stupendous erudition, the author of numerous works bearing upon criminal law and criminology, and the editor, since 1898, of the important *Archiv für Kriminal-Anthropologie und Kriminalistik* (usually cited as *H. Gross' Archiv*). In his great work *Criminal Psychology* (English translation, 1911) Gross has given us the most authoritative and comprehensive exposition of the mental states of criminals and likewise of judges, juries, experts and witnesses. His labors have touched psychological and educational problems at various points, so that his death is a loss in these fields as well as in the field of jurisprudence.

Dr. L. W. Rapeer, professor of education at the Pennsylvania State College, will give a course of lectures for one week at the opening of the summer session of the University of Kansas. The subject of the course will be "The Administration of Educational Hygiene." —*School and Society.*

It is stated in *Midland Schools* that through the coöperation of fifty of the leading business and professional men of Stevens Point, Wis., President John F. Sims, of the Stevens Point State Normal School, has secured Dr. Montessori to give her teacher training course under the auspices of the normal school. Dr. Montessori and her assistants will come from San Francisco in time to open the course on Monday, January 24, 1916. The course will continue for a term of six months, and, in addition to the lectures given by Dr. Montessori, lectures will be given by her assistants, and a demonstration school will be in operation for the purposes of study and observation under the personal supervision of Dr. Montessori. The fact that the training course is to be given under the auspices of the State Normal School makes it possible to place the tuition fee at about one-third of the regular rate. Principal F. S. Hyer, of the training school, is chairman of the enrollment committee.—*School and Society.*

The new research department of the Whittier California State School, under the direction of Mr. J. Harold Williams, is undertaking to apply the results of modern psychological studies and of mental testing to the education of delinquent boys. As a result of the application of the Binet tests last year, it became evident that fully twenty-five per cent. of the boys in the school were mentally so retarded that they could not pursue academic work profitably. The other boys will be classified on the basis of mentality tests, and their instruction will be carried on in groups determined by intelligence levels and trade aptitudes. Mr. Williams will be assisted in the conduct of the research department by Mr. Karl Cowdery, representing the Eugenics Record Office, who will carry on research among the families of the boys of this school.

Professor C. E. Benson, from the Kearney Normal School, Nebraska, goes to the State Normal School at Cape Girardeau, Missouri, to take charge of the department of education.—*School and Society.*

CURRENT PERIODICALS

EDUCATIONAL ADMINISTRATION AND SUPERVISION. Vol. I, No. 2, February, 1915. DON C. BLISS. *School Measurements and School Administration.* 79-88. Presents an account of the improvement in school work from September to May in handwriting, spelling, and arithmetic in grades, five, six, and seven, as measured by standard scales.

S. A. COURTIS. *Educational Diagnosis.* 89-116. The author uses the results obtained from the application of his standard tests to show how groundless are the fears of those who assert that the tendency of educational measurements is to reduce educational effort to a dead level of uniformity. On the contrary, the application of such measures serves to bring out in clear relief the individuality of the child and the particular treatment needed for his fullest development. Nothing makes for greater individualization in instruction than the exact determination of the status of the pupil in each school subject and in each phase of that subject. The author believes that by the use of standard tests, the efficiency of our teachers will be doubled in ten years.

HAROLD ORDWAY RUGG. *Teachers' Marks and Marking Systems.* 117-142. An excellent summary of the recent investigations of the distribution and reliability of teachers' marks, and their significance for the school administrator. There is a bibliography of thirty-nine numbers.

No. 3. March, 1915. ELLEN M. GREANY. *A Study of the Vocational Guidance of Grammar School Pupils.* 173-194. The article presents the results of an investigation in four Massachuesetts city schools to determine how clear an idea eighth grade elementary school pupils have of a vocation, to find how this vocational vision has been acquired, and to discover the effect of a course of systematic expository instruction in vocational and educational opportunities. The instruction consisted of nine lessons on opportunities for boys and girls. Parallel groups of uninstructed children were selected for observation, and a year later it was found that a considerably higher percentage of the instructed than of the uninstructed group were engaged in work that would help fit them for the work they eventually intended to pursue; while a very much smaller percentage of the instructed were found in "blind alley" occupations.

CHARLES L. HARLAN. *Size of Class as a Factor in School Room Efficiency.* 195-214. Data was secured on this point by a study of promotion rate, percentage of withdrawals from the class, scores in arithmetic made in the Courtis test, percentage of class not giving attention during recitation, percentage of class not participating in work of recitation, time spent in performing the various routine ac-

tivities of the school room, and percentage of time wasted by the class during study period. The author concluded that the class of medium size (23 pupils) seem too small for the most economical administration of our schools. The optimum size of the class seems to be from thirty to forty pupils.

No. 4. April, 1915. ALFRED L. HALL-QUEST. *Present Tendencies in Supervised Study.* 239-256 The author reports the results of a postal card questionnaire sent 969 high school principals in every state of the Union. Replies were received from 532 schools. Of these 87 per cent. claim that they have supervised study, chiefly in the assembly hall, but in the methods of securing this supervision, there is the widest variation. A somewhat detailed account is given of the experiments in supervised study that have been carried on in Joliet, Ill., and Bloomington, Ind.

No. 5. May, 1915. EDWARD C. ELLIOTT. *How shall the Merit of Teachers be Tested and Recorded?* 291-299. The author discusses the work that has been done in recent years in measuring the merit of teachers, reaffirms his faith in the desirability and practicability of such objective measures of efficiency, and calls for further co-operative experimental work to determine the reliability of methods of measurement and their usefulness for school officers.

EDWARD L. THORNDIKE. *Means of Measuring School Achievements in Handwriting.* 300-305. Assuming the use of either the Thorndike or the Ayres scale, the author discusses the question of how many samples of handwriting must be measured to get a valid result for a school system. Suggestions are made for sampling schools and grades in a system, for sampling pupils within each grade, and for sampling papers in relation to judges. Directions are also given for the conduct of tests in handwriting.

EDWARD L. THORNDIKE. *Means of Measuring School Achievement in Spelling.* 306-312. Selections of words are made from Buckingham's spelling lists, and records are given for imaginary grades, schools, and school systems.

ERNEST C. WITHAM. *All the Elements of Handwriting Measured.* 313-324. The author considers that all the elements of handwriting are embraced under the rubrics of speed, legibility, and form and beauty. The author takes as his index of legibility the speed or amount of time required to write a given passage divided by the number of seconds it takes the pupil to read what he himself has written. Form and beauty may be measured by any of the standard scales, but the author prefers a scale for each grade constructed by the teachers themselves. The results of several measurements are recorded and from these it would seem that the home-made scale suits the author's purpose better.

No. 7. September, 1915. HENRY BUELLESFIELD. *Causes of Failure Among Teachers.* 439-452. The author reports the results of a questionnaire sent to 300 schools on the subject of the causes of failure. From these 140 replies were received. The first interesting

conclusion is that the per cent. of failures varies inversely with the number of teachers employed. In systems employing from nine to nineteen teachers, the percentage of failure is eleven times that in systems employing from 109 to 159 teachers. This seems to be due to the more careful selection of teachers in the larger schools. There are tables showing the distribution of failures in elementary and high schools according to sex and the number of teachers employed, the subject taught, and the amount of previous experience. By far the most frequent cause of failure is given as weakness in discipline. Unfortunately it is difficult to distinguish between this and other important causes of failure, such as lack of judgment, lack of sympathy, too nervous, could not control temper, etc. It is doubtful whether the mere tabulation of the judgment of supervisors will avail us much in understanding the causes of failure in teaching. A more detailed and intimate analysis of specific situations instead of the rough and ready judgments of superintendents is much to be desired.

No. 8. October, 1915. J. C. BROWN AND J. H. MINNICK. *A Study of the Preferences of Secondary School Pupils for the Various Subjects and of the Ranking of the Various Subjects on the Basis of Utility, as Judged by the Pupils.* 527-545. The data on which this article is based were derived from the Horace Mann School for Boys, and the Horace Mann School for Girls. The ranking of subjects by boys is chemistry, algebra, geometry, manual training, English, etc., and as ranked by girls, the first five choices are, English, history, arithmetic, trigonometry, and geometry. Interesting information is also obtained on what subjects were considered the most useful and the most useless, and on the subjects that they were then studying that they would most like to drop.

No. 9. November, 1915. J. L. MANAHAN. *Grading and Promotion of High School Pupils.* 577-590. A study of the distribution of the marks given to a class of 627 pupils of the Somerville, Massachusetts, high school during the four years of the course, and the distribution of marks in the separate departments, as mathematics, English, etc. Mathematics shows by far the highest percentage of failures; and the figures raise the question whether the teaching is satisfactory, or the course is properly suited to the needs of the pupils.

J. C. BROWN AND J. H. MINNICK. *A Study of the Preferences of Secondary School Pupils for the Various Subjects, and their Reasons for the Preferences.* 599-610. This paper is continuation of a study previously reported, and extends the investigation to 1600 pupils in the high schools of Decatur, Illinois, Dubuque, Iowa, and Hackensack, New Jersey. Among the subjects ranked relatively high by pupils are the commercial subjects, English, and mathematics; while the languages and history are ranked relatively low. Boys manifest a greater interest than girls in book keeping, mathematics, chemistry, and physics; while the girls show a greater interest in stenography, typewriting, English, and foreign languages.

No. 10. December, 1915. CARTER ALEXANDER. *A Laboratory Exercise in School Administration.* 646-654. The following problem was presented to a group of five students: How many and how varied standards existed for the assignment of grades in a local high school in the year 1913-14; what common standards could be worked out from the available data and urged for the acceptance of the school as a whole; and what practical suggestions could be made for the application of these standards by the several teachers? A study of the grades given shows that some teachers are more severe in grading boys and girls and vice versa; that the teachers vary greatly in the percentage of failures; and that the majority of teachers grade closely enough about a common scale to warrant taking this as a standard for the whole school. Suggestions are made for keeping this standard before the attention of the teachers.

ANNA EICHHORN. *Cheating in High School.* 655-662. The article reports the results of a questionnaire submitted to 1000 students in the high school of Decatur, Illinois. The answers to each of the ten questions are summarized and discussed. The indirect evidence as to the amount of cheating in the high school and the attitude of the pupils towards it is somewhat disquieting Both estimates and confessions place the percentage of cheating at about 40, but the answers to some of the questions show that much can be done if the fundamental principles underlying the honor system are brought clearly before the minds of the pupils in debates, class discussions, literary societies, and in the high school paper.

E. E. LEWIS. *The Present Standard of Handwriting in Iowa Normal Training High Schools.* 663-671. The handwriting of 1760 third and fourth year students was rated by six judges on the basis of the Ayres Scale. The author finds that the maximum variation between the judgments of the six judges will not be over 10 points, or one step, in about six out of ten cases. As compared with the ordinary percentile method of rating handwriting the use of the scale reduces the variation by almost one-half. There was no apparent correlation between speed and quality.

PUBLICATIONS RECEIVED

KATHARINE ANTHONY. *Feminism in Germany and Scandinavia.* New York: Henry Holt & Company, 1915. Pp. vi, 260. $1.25.

This is a clear and readable account of the woman's movement in Germany and Scandinavian countries. The first chapter gives a good sketch of the unity of thinking which prevails amongst the women of northern Europe. This is followed by chapters on schools and the woman, on dress reform, on the protection of motherhood and maternity insurance, on the status of the illegitimate child, and on the fundamental philosophy of German feminists. The author shows how intensely interested in the schools the new woman is, and what changes have been brought about in the education of girls. The book contains a good working bibliography.

ADOLF A. BERLE. *Teaching in the Home.* New York: Moffat, Yard and Company, 1915. Pp. xxii, 354. $1.25.

The sub-title of this book is "A Handbook for Intensive Fertilization of the Child Mind for Instructors of Young Children." In his introductory "Letter to Teaching Parents," the author says that the book has grown out of the requests for guidance and information coming from parents who had read his previous book "School in the Home." The author believes that education should deal with negotiable knowledge. While it is true that much of the knowledge which the school inculcates is non-negotiable, the author begs his readers not to fight the school on this account but rather to help it, and if he could induce intelligent fathers and mothers to take the kind of interest in schools which he recommends, it would be the most powerful means for the improvement of educational facilities that could be imagined. The book is written in an easy conversational style, and has chapters on English, grammar, foreign languages, geography, history, physiology, botany, zoölogy, geology, and geometry. In the final chapter the author makes some excellent suggestions in regard to books that parents should have in their libraries.

FOSTER PARTRIDGE BOSWELL. *The Aims and Defects of College Education.* Hobart College Series Number 1. New York: G. P. Putnam's Sons, 1915. Pp. vii, 78. 80c.

The author endeavored to ascertain the opinions of prominent Americans on the two following questions: "What traits of character and mind should a college aim to develop in its students to make them useful and efficient in modern life?" and "In what ways

does the present college education fail in giving students training it is able to give?" The first part of the book is made up entirely of quotations from the replies. In part two, the author sums up the results and implications of these views. The three most important recommendations, according to the author, are that the college should impart to its students a deeper sense of the duty of public service; that each college should organize a committee on vocational guidance to aid its students in making wise choices of future occupations; and that members of the faculty should make a better use of their opportunities for moulding and determining undergraduate tradition.

HARRIETTE BROWER. *Piano Mastery. Talks with Master Pianists and Teachers.* New York: Frederick A. Stokes Company, 1915. Pp. x, 299. $1.50.

This is a valuable series of interviews with many of the most eminent piano teachers and virtuosi on important points in piano teaching and piano technique. Among the artists represented are Paderewski, Schelling, Tina Lerner, Goodson, Hambourg, Bauer, Busoni, Careno, Lambert, Zeisler, Schnitzer, Gabrilowitsch, von Buelow, William Sherwood, and Dr. William Mason. These interviews are not of the ordinary superficial newspaper type but drive straight at the difficulties which the artists have encountered and the means taken to overcome these difficulties. It is a valuable book for anyone who is interested in the piano.

MARY WHITON CALKINS. *The Self in Scientific Psychology.* Reprinted from the American Journal of Psychology, vol. xxvi, Oct., 1915. 495–524.

The author here takes up in detail some of the attacks that have been made upon the concept of self as a fundamental one in psychology, and reviews the work of Katzaroff, Mischotte and Pruem, Ach, and others, showing how the concept of self is at least implicit in all their work. She explains why the self can never be discovered by pure introspection, and is, therefore, ruled out of court by those who can see no place for anything but an introspective psychology.

WILLIAM E. CARSON. *The Marriage Revolt. A Study of Marriage and Divorce.* New York: Hearst's International Library Co., 1915. Pp. xiv, 481. $2.00.

The object of this book is "to present the facts and opinions that have led to what appears to be a wide-spread revolt against conventional marriage and an equally widespread increase of divorce; next, to discover to what extent any new definite conceptions emerging from the conflict are finding acceptance; and lastly, from an exam-

ination and analysis of causes and effects to obtain a forecast of probable future results." There are chapters on woman's emancipation and its influence on family life, the ideal marriage, the increase of divorce, experiments in the enactments of state laws, the workings of the court of domestic relations, a study of the divorce colony at Reno, Nevada, divorce problems in England, the influence of modern scientific thought on marriage, and suggested remedies for present evils. It is a broad-minded and unbiased survey of present tendencies on this important social topic.

C. H. Claudy. *"Tell-Me-Why" Stories about Color and Sound.* New York: Robert M. McBride and Company, 1915. Pp. 235. $1.25.

In the ten chapters of this book the author sets forth in almost startlingly unconventional form the origins of music and pictorial art. "The Story of the Law of Wiggle" sets forth the essential phenomena of vibration, "The Story of the First-of-all First Fifes," deals with the development of wood wind instruments, "The Story of the Light Children" is an account of the spectrum, and other stories recount the development of music and painting as arts.

Caroline Crawford and Elizabeth Rose Fogg. *The Rhythms of Childhood.* New York: The A. S. Barnes Company, 1915. Pp. 84. $1.50.

This little book of rhythms gives some of the patterns or designs that are universal expressions in all child activity, and calls them by names that suggest the mood as well as the action. In order to show the relation between the child's art expression and the evolution of the dramatic arts a selection of folk music similar in mood and type is placed opposite each rhythmic form. We have tried these little tunes with children and have found that their appeal is immediate and direct. The book can be enthusiastically recommended to kindergarten and primary teachers.

Ellwood P. Cubberley and Edward C. Elliott. *State and County School Administration. Volume 2, Source Book.* New York: The Macmillan Company, 1915. Pp. xxi, 729. $2.00.

The authors have rendered a valuable service in getting together into one volume the widely scattered material dealing with state and county school administration. This is a companion volume to a textbook of Principles of State and County School Administration, which is in preparation and may be expected in the near future. The material in the present volume is arranged in seven divisions as follows: I. American Federal and State Policy, II. State Administrative Organization, III. Extent of the Educational System, IV.

Financing the School System, V. Material Environment and Equipment, VI. The State and the Teacher, VII. The Oversight of the State. The volume is packed from cover to cover with data which are of importance and interest to the school administrator.

Educational Directory 1915–16. Bulletin 1915 No. 43, Washington: Bureau of Education. Pp. 192.

Contains lists of national and state educational authorities, city and county superintendents, trustees and presidents of universities and colleges, professors of pedagogy in universities and colleges, principals of normal and kindergarten training schools, superintendents of schools for the blind, deaf, and feeble-minded, librarians, educational foundations, educational periodicals, and educational officials in foreign countries.

C. Truman Gray. *A Score Card for the Measurement of Handwriting.* Bulletin of the University of Texas, 1915. No. 37. Pp. 50.

The author's problem is two-fold, involving the determination of the elements of handwriting, and the assignment of relative values to these elements. There is an introductory chapter on educational measurements and the use of the score card in education, an account of the determination of the points which enter into the score card, and the evaluation of these points on the basis of the judgments of teachers and supervisors of writing, of elementary school teachers, and of teachers and students of education. The weighting of the various rubrics was determined by the Thorndike method and by the method of the regression equation, as recently employed by Dr. Truman L. Kelley. The monograph constitutes an interesting contribution to the subject of educational measurements.

Edward Cary Hayes. *Introduction to the Study of Sociology.* New York: D. Appleton and Company, 1915. Pp. xviii, 718. $2.50.

This work discusses in detail the practical social problems of our day and shows clearly how the individual personality is shaped by society, including the society of the school, the playground, and the home; how society is shaped by natural causes; and how it may be modified by the coöperative endeavor of individuals. The publishers claim that it is the only comprehensive work on sociology that leads up to and culminates in a treatment of the problems of education from the sociological point of view. Part One discusses the causes which affect the life of society, including geographic conditions, rural or urban conditions, the distribution of wealth, heredity, and eugenics, immigration, public health, and social suggestion. In Part Two the nature of the life of society is outlined, and social activities are analyzed and classified. Part Three treats of social evolution, and Part Four of social control, including the growth of law, crime, its causes and treatment, religion, politics, and education.

WILLIAM HEALY. *Honesty. A Study of the Causes and Treatment of Dishonesty among Children.* Childhood and Youth Series. Indianapolis: The Bobbs-Merrill Co., 1915. Pp. 220. $1.00.

As advisor to the Judge of the Juvenile Court of Chicago the author has had exceptional opportunities to study all types of deviation from accepted standards of honesty and to identify the essential motives leading to dishonesty. The results of his observations are here set forth in simple, non-technical style for the benefit of teachers and parents. Some of the more important chapter headings are home conditions and parental behavior, companionship, discipline, amusement and adventure, mental, physical, and social habits, and dishonesty as an outgrowth of various forms of abnormal mentality.

JOSEPH LINDSEY HENDERSON. *State Systems of High School Inspection.* Reprinted from Educational Administration and Supervision, Vol. 1, No. 8, Oct., 1915. 493–510.

A summary of current methods of high school inspection by states.

ARTHUR HOLMES. *Backward Children.* Childhood and Youth Series. Indianapolis: The Bobbs-Merrill Co., 1915. Pp. 247. $1.00.

"We are these days hearing and reading a good deal about backward children. When is a child backward? May he be backward in some ways and forward in others? Are children backward by birth or are they made so by neglect or bad methods of training? What are the signs of backwardness? Is there any way of determining accurately whether or not a given child is permanently arrested? Could the parents and the teacher help an unfortunate child if they could early detect his shortcomings? What part do physical causes play in mental and moral backwardness? These and similar questions it is the purpose of this volume to discuss in a scientific but at the same time simple, concrete and practical way." This quotation from the editor's introduction indicates the aim of the present book. The questions are answered largely by the citation of specific cases, and this gives the book an anecdotal character which makes it very interesting reading.

FRANK MITCHELL LEAVITT AND EDITH BROWN. *Prevocational Education in the Public Schools.* Boston: Houghton Mifflin Company, 1915. vii, 245.

The authors of this work have collected and organized data which have been derived during the past three years from an experimental industrial class in the University of Chicago and the prevocational classes in the Albert G. Lane Technical High School. They have

also studied the prevocational work in other cities, and the book is, therefore, representative of the most advanced thinking in this field. Among the questions discussed are the place of prevocational work in the school system, local aspects of vocational education, the best method of inaugurating prevocational classes, characteristics of prevocational boys, and the appropriate subject-matter for such classes, including physiology and hygiene, history, science, English, mathematics, shop-work, and drawing.

Report of a Survey of the School System of Salt Lake City, Utah. Salt Lake City: Board of Education, 1915. Pp. xiii, 324.

This survey was authorized by the Board of Education, May 4, 1915, and was carried out by Ellwood P. Cubberley, Director, Jas. H. Van Sickle, Louis M. Terman, Jesse E. Sears, and J. Harold Williams, all, with the exception of Superintendent Van Sickle connected with Leland Stanford University. Part One deals with organization and administration, and discusses the character of the city and its needs, the organization of the school system and its defects, the administration of the educational department and the part played therein by the school principals, the good and bad features of the teacher situation, and the increase in school census and school attendance. Part Two deals with the work of the schools, including the printed courses of study, the instruction and supervision as seen by the members of the survey, measurements of the efficiency of the instruction, and the progress of children through the schools. Part Three describes the school plant, summarizes the arrangements for health supervision, and the general status of health among school children, and discusses the physical education, playground activities and hygiene teaching in the schools. Part Four deals with school finances, and in an appendix is suggested a law for the management of Salt Lake City School District. In measuring the efficiency of the instruction, tests were given in reading, writing, spelling, composition, and arithmetic. In spelling, the Ayres Springfield test was used, and the results show that Salt Lake City schools rank well above those in other cities in all grades except the eighth. A composition test was given and the papers were scored by the use of the Hillegas scale. A dictation test was given to indicate the handwriting of the pupils and this was scored by the Thorndike scale. The Courtis tests in reading and arithmetic were employed and the Stone series of arithmetical problems was used to test reasoning in arithmetic. In arithmetic work pupils of Salt Lake City are distinctly in advance of other city systems that have been measured.

Marie L. Shedlock. *The Art of the Story-Teller.* New York: D. Appleton and Company, 1915. Pp. xvii, 288. $1.50.

"Some day we shall have a science of education comparable to the science of medicine; but even when that day arrives the *art* of education will still remain the inspiration and the guide of all wise

teachers. The laws that regulate our physical and mental development will be reduced to order; but the impulses which lead each new generation to play its way into possession of all that is best in life will still have to be interpreted for us by the artists who, with the wisdom of years, have not lost the direct vision of children." Thus speaks Earl Barnes in his introduction to this book, and he recommends the author as one who is equally at home in interpreting the wit and wisdom of Daudet, the folk-lore of Grimm, and the deeper world philosophy of Hans Christian Andersen. The author has here put together such observations and suggestions of story-telling as can be put into words. There are chapters on the difficulty of the story, the artifices of story-telling, elements to avoid and to seek, and hints on how to maintain the effect of the story. Part Two contains a series of eighteen carefully selected stories with an appeal to children, and Part Three gives a bibliography of sources that will be useful to the story-teller.

JAMES MONROE TAYLOR AND ELIZABETH HAZELTON HAIGHT. *Vassar.* New York: Oxford University Press, 1915. Pp. 232.

This authoritative history of the oldest college for women in America, by one who has spent the best years of his life in her service as president, will be of value for all those who are interested in the history of higher education in America. The book is in some sense a sequel to Dr. Taylor's earlier work "Before Vassar Opened" which appeared some months ago. Founded in 1865, the college has gone through three more or less distinct periods—the period of development, from 1865 to 1878, the period of discouragement, from 1878 to 1885, and the period of expansion, from 1886 to the present. An interesting exhibit in the appendix is a comparison of the financial summary for 1878 with that for 1914.

J. E. TOLSON. *Scissors Stories or Picture Cutting for Little People.* New York: E. P. Dutton and Company, 1915. Pp. xvi, 160. $1.00.

The delight in paper-cutting is one of the earliest manifestations of constructive ability, and this interest, according to the author, can be utilized as a valuable educational process, if properly organized and stimulated. The author believes that the application of mass cutting is very wide and as a hand-maid to drawing and handwork generally it ranks very high. It gives great scope to original and imaginative work, and children should be encouraged from the first to build their own pictures. Among the topics considered are paper-tearing, paper-folding, straight line cutting, cuttings from the square and the oblong, cutting illustrations for stories, picture cutting in connection with the recitation, as in geography and history, cutting to illustrate trades, sports, and the week's work, cutting applied to

reading and language training, and dictated cutting. The book contains 135 illustrations, and forms an excellent manual in the hands of an ingenious teacher.

WILLIAM T. WHITNEY. *The Socialized Recitation.* New York: The A. S. Barnes Company, 1915. Pp. x, 100.

We hear much good sermonizing about the desirability of socializing the recitation, but the difficulties in actually carrying this advice into practice are so great that the average teacher falls back upon the mechanical routine of the traditional recitation as a vastly easier method of procedure. The present little book was written not only with the aim of inculcating the desirability of socializing the recitation, but with the purpose of showing by means of concrete examples how teachers may put the plan into execution. There are chapters on socializing the history period, the socialization of the arithmetic period, socializing oral reading. Over half of the book is devoted to actual illustrative lessons, which were taken down stenographically as they were taught to children. The book should prove helpful and stimulating to elementary teachers.

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